EXPLORING THE ENVIRONMENT WITH THE HANDICAPPED

Edited by:
M. Jane Watson

Ministry of the Environment
Ontario

SCOUTS CANADA

Published by:

Information Services Branch
Ministry of the Environment
135 St. Clair Avenue West
Toronto, Ontario
M4V 1P5

Boy Scouts of Canada
Provincial Council for Ontario
Scouting With the Handicapped
Advisory Committee

PREFACE

"Exploring the Environment with the Handicapped" was prepared for the Ontario Ministry of the Environment in co-operation with the Boy Scouts of Canada, Provincial Council for Ontario, Scouting with the Handicapped Advisory Committee.

Members of the Committee reviewed draft copies of the manual and made valuable suggestions in light of their experiences in working with handicapped children.

This manual is designed primarily to assist leaders of handicapped groups to investigate the natural world with their "special" youngsters - the vision impaired, hard-of-hearing, physically or mentally handicapped. It does not seek to replace any other Boy Scout or environmental materials but merely to supplement them.

There are very few environmental education resource materials on today's market that encourages a person with limited environmental knowledge to work and learn with handicapped youngsters in the out of doors. Yet children with both physical and mental handicaps need opportunities to explore their environment and to expand their perceptions of the world. All sorts of sensory experiences are essential to their perceptual and conceptual development.

The ultimate decision as to which activities, or parts of activities, are undertaken and the time spent on each one rests with the group leader. For only he or she alone is able to judge the interest, ability, knowledge, experience, attention span and other factors that affect the importance of a specific topic for each child in the group.

The material in this manual was selected for its ability to be easily used or modified to meet the learning capabilities of all youngsters whether they are handicapped or not. Many sections are followed by ideas for adapting the materials to fit the needs of vision impaired, hard-of-hearing, mentally or physically handicapped youngsters. These are certainly not all of the adaptations possible. Every leader has his own methods of working with his or her group and gearing activities to the appropriate level.

The important thing to remember, however, is that adaptations tend to emphasize handicaps so they should be kept to a minimum and used only when necessary for the child's understanding, learning or physical abilities. "Special" children should have as many opportunities as possible to participate in the same activities as non-handicapped youngsters.

TABLE OF CONTENTS

TIPS ON DEALING WITH THE HANDICAPPED

A college student made this remark: "I've always been scared to death of the handicapped. I never knew any personally and wondered what I would do if I had to talk to one of them."

1) Offer help when it looks as though it might be needed but do not insist on it if the individual refuses aid.

2) Don't "hover". Handicapped people do not wish to be treated as babies. Children react the same way, they want to be like you and me.

3) When a handicapped person falls, take it easy. Wait for him to give you a cue. If he can get up by himself, he may prefer doing that; if he needs a lift, he will tell you which is the easiest way to get him back on his feet.

4) Crutches and wheelchairs are necessary accessories. Don't take them away from the handicapped person unless he indicated he would like to have them out of the way. Nothing is more irritating than to have your crutches grabbed quickly as soon as you hit the chair, leaving you stranded.

5) Vehicles are difficult even for the young and agile. The handicapped often need help here. Again, let them tell you how to help. Those who do not need to be carried up the steps usually have methods of their own for making them. Do not pull an arm or push from behind unless such assistance has been requested. Precarious balance can be lost entirely with such tactics.

6) Keep your perspective. As Gertrude Stein might say, "An arm is an arm is an arm" and "a leg is a leg is a leg". It is just that. An arm is an arm and a leg is a leg. This is not the whole person.

7) Relax. No matter what you do, if you are friendly and kind, the handicapped person is going to like you.

8) Have fun. Talk about the same things you would with any other person. A physical handicap does not necessarily limit your interest or dampen your sense of humour.

9) Be yourself. Don't be sticky sweet. Omit the pious note.

10) Let common sense and consideration be your guide, and you will never err seriously. The disabled are just like you are, only with a physical difference that does not have to make them feel or think differently.

11) When in doubt ask -- "May I help you?" "How can I help?"

12) Remember that it is a whole person that we are dealing with. It is not a Cerebral Palsy, a Polio, a Muscular Dystrophy. It is a person afflicted with Cerebral Palsy, etc., etc.[1]

[1] National Counil of Boy Scouts of Canada. Scouting for Boys with Handicaps - A Leader's Guide. 1976, pp. 53.

Handicapped people can receive the same benefits from environmental programs as do the non-handicapped: change of scenery, introduction to new knowledge, stimulation to pursue new interests, relaxed social interaction that can possibly lead to a greater understanding between different types of people, and a pushing outward of the boundaries of their particular worlds.

Unfortunately, many group leaders, teachers, interpreters, etc. are hesitant to involve handicapped individuals in environmental activities because they assume it will mean numerous complex and expensive adaptations to existing programs. This is a gross misconception.

Except for the restroom, stair and entrance way difficulties associated with wheelchairs, most standard environmental programs and facilities can be used successfully with handicapped individuals.

In fact, adaptations should be limited as much as possible as they tend to emphasize handicaps. Naturally, thought has to be given to the mental capacities of the individuals but on the whole it is not only important but it is the right of the handicapped to receive the same knowledge and opportunity to experience their surroundings as do their non-handicapped peers.

The age of overprotectiveness is over! Emphasis must now be placed on encouraging handicapped individuals to use all of their available senses to explore the exciting world around them.

VISUAL HANDICAPS

Individuals who have visual handicaps can be divided into one of three categories:

1. Those who have been blind since birth. Special efforts must be made to help these individuals yet they usually learn easily and fit into the same play patterns as their sighted friends. They do, however, need more supervision and patient help. It helps to describe things for them in terms of something they have been able to touch or hear. They have no concept of color.

2. Those who have gone blind. These individuals must learn to adapt their lives to a new set of conditions and to use their hands and ears in new ways. When describing things for them, refer to things they were once able to see for themselves and picture in their minds.

3. The partially sighted. These individuals have limited vision. Care should be taken not to do things which may be harmful to their remaining sight.

The daily life of the blind or partially sighted child is subject to many petty embarrassments such as the half open door or the unexpected step. The blind child has a keen desire to be independent and is sensitive to impressions.

A common misconception is that blind people develop some sort of "sixth" sense. What is developed instead is an alertness much greater than in sighted individuals and a better memory.

Another misconception is that all blind people can read Braille. Factors such as age, extent of education, type of living habits, and type of employment at the onset of blindness determine whether a person will learn Braille, and how much. Braille is only essential if the newly blind person is pre-school age and has most of his learning ahead of him.

Most blind people do not want special facilities developed for them. They do not want to feel different or to be treated as handicapped. Because of his heightened sensory awareness, a blind person has little need of a rope trail; in fact it limits him. The blind can be easily accomodated on regular trails. If possible or desired, a change in the surfacing material on a self-guiding trail can be used as a signal to a blind person that he is at another station.

Environmental programs can be of special benefit to the blind. Many visually impaired children have spent a great deal of their young lives in residential school settings. They are usually restricted in their mobility and a large percentage live in urban areas. They can not be expected to have had much experience with

the natural environment. And of course the child who has had little limited sensory contact with the environment will, unless properly educated, grow up without a clear view of the world in which he lives. He uses the words he has been given-"verbalisms" — to carry on conversations with others but actually has no real knowledge or understanding of his surroundings.

By providing activities to enable the visually impaired to explore the natural world firsthand and become familiar with many situations otherwise unreal to them, you can give the visually impaired a better understanding of the world.

Suggestions for Working with the Visually Handicapped:

1. Activities should be designed to allow full use of senses of touch, smell, hearing and taste. Instead of asking "what does it look like", ask "what can you tell me about it". This also helps to increase language use and development.

2. Do not hesitate to offer help. He will let you know if he can manage alone.

3. If you do not know how to help, ask him.

4. Gently touching his elbow will let him know you are addressing him.

5. Do not touch his cane or dog.

6. If you are helping him walk, offer him your arm rather than taking his. He can guide by the motion of your body. Try to sense the right speed for him.

7. When you meet always introduce yourself first.

8. Let him know when you are approaching or leaving.

9. Do not address him through someone else. Never say "What does he want?" instead "What do you want?"

10. When seating him, place his hand on the back of the chair or bench.

11. Use words such as "see" and "look".

12. Ensure that items are always in the same place, keep doors shut, carefully store dangerous articles such as axes and saws.

13. On outdoor activities use precise phrases such as "four steps to your left" or "at arms length at 2 o'clock" to describe obstacles and landmarks. Blind children are usually trained early to organize things in a clockwise direction.

14. Although it is helpful for blind people to have objects identified for them, moderation should prevail. Normal periods of silence should occur.

15. Do not be overprotective. Blind people must handle needles, pins, scissors, knives, etc. and so on as part of their everyday lives.

16. Do not always use a partner approach with the partner describing things to the visually impaired child. This burdens the sighted child and encourages the handicapped child to fade into the background. Allow the handicapped child to make his own observations.

17. Much of our communication is non-verbal, with an important part being played by gestures and eye contact. The visually impaired cannot see these and therefore never use them unless trained to. Thus, the sighted can at times have an uncomfortable feeling of talking to an unfeeling zombie. Try to overcome this.

For the Partially Sighted:

18. If the child is to receive written information, try to ensure that the material is typed in capital letters.

19. Allow extra time for any project which requires reading or writing.

20. If lengthy research is required, show the child where he can find the relevant information.

21. Permit as much hands on work as possible.

PHYSICAL HANDICAPS

For the purpose of this manual, individuals with ambulatory limitations, which require them to use wheelchairs, crutches, leg braces, canes, or walkers, are physically handicapped. Their major problem is in the design of buildings, entrance ways, street curbs, pathway surfaces, restrooms, buses, stairs, pay telephones, etc. Their mental capacities are usually the same as those who are non-handicapped.

First and foremost, the physically handicapped child needs to be treated as a normal child. He should be allowed to do and to experience as much as possible, the same things as his friends. He should be encouraged to play in the snow, get dirty grubbing for insects in the woods, get wet looking at aquatic plants, etc. -- all the things normal children do. Never overprotect him.

Children with physical handicaps need opportunities to explore their environment and to expand their perception of the world. It is essential to their perceptual and conceptual development that they have sensory experiences with all sorts of materials.

Suggestions for Working with the Physically Handicapped:

Wheelchairs

1. All children using wheelchairs should be tied in the chair.

2. If you have to go down a steep hill, take the chair down backwards.

3. Don't pull on the arms of the chair -- they may come off. Hold the handlebars.

4. Whenever you stop to chat with someone, turn the chair so that the handicapped person can take part in the conversation. If possible, sit down so the person in the chair doesn't have to strain to see your face.

5. Most wheelchairs have brakes and should be used. If they do not have brakes, blocks of wood or similar objects should be placed in front and behind the back wheels.

6. If it is necessary to lift a child, get assistance. There are special techniques employed in transferring and lifting, it would be wise to check with the parent, nurse or therapist as to which method to use. Do not use your back muscles to lift!

7. Many children have been trained to transfer themselves from wheelchairs to toilet and back. Find out what the child can do for himself and offer assistance only when necessary.

8. These children often feel weather conditions more acutely because they can not move about freely. Ensure that they are dressed appropriately and are wearing hats when in the sun for long periods.

Canes or Crutches

9. Watch for accident hazards which may trip the child. The rubber tips on crutches and canes tend to pick up wax from floors and become slippery and hazardous.

10. Don't take away crutches or canes when the person sits down, unless he indicates he would like them out of the way.

11. If help is asked for, offer your arms or grasp the person's firmly. Gripping too tightly may inhibit the movement of the arm or aid. Pulling on the arm may cause the person to stumble.

12. When walking allow the handicapped person to set the pace.

13. If you see a handicapped person struggling with a door, be careful not to open it too quickly from the other side, or they may lose their balance.

14. Should a person fall, don't panic or fuss. He will tell you best how to help.

Braces, Protheses, Appliances

There are many different types of braces, protheses and appliances. Each article is made especially for the handicapped person. Some may be used to immobilize a joint, others to prevent muscle contractions, and still others may provide support and stability. If the brace has knee or ankle locks, the child should know whether they should be locked or unlocked when the child is walking or sitting. For suggestions on working with people who use these devices, please refer to the preceding section on crutches and canes.

Paraplegia

In addition to the points listed above, children who suffer from paralysis need special consideration as they have little or no sensation in parts of their bodies.

15. Avoid giving them hot articles without providing proper protection. They may be unaware if a plate or cup is burning them.

16. Do not place them in sunlight for long periods.

17. If you have to assist the child in putting on some articles of clothes, take special care. He may be unable to tell you if a toe is turned under, or a shoe is rubbing or if a garment is cutting off circulation.

Note: A child who is crippled tires easily and care should be taken that he does not over-tire.

CEREBRAL PALSY

Cerebral palsy is a term used to describe a group of conditions brought about by damage or malfunction of a part or parts of the brain. It is a motor problem usually accompanied by other handicaps, which may involve vision and/or hearing loss, tactile or perceptual difficulties, poor speech patterns, emotional disturbances, convulsions or mental retardation. The extent of the handicap ranges from five percent to total disability.

There are three main forms of cerebral palsy - spasticity, athetosis and ataxia. Those afflicted by all three types are commonly called "spastic".

The "spastic" child has muscle weakness, disordered movement and often disturbances in growth and development. It may affect both the limbs on one side of the body, both the limbs or all four.

The "athetoid" child has frequent involuntary movements which mask and interfere with the normal movements of the whole body.

The child with "ataxia" has an unsteady gait and difficulty in maintaining balance.

Seriously handicapped spastics may have various combinations of these basic categories with one of the forms being more prominent than the others.

Few spastics are mentally deficient. Those who are facially deformed are often the most intelligent.

Many spastic children exhibit immaturity, underdeveloped personalities, impatient and self-centredness and an inability to understand certain situations and points of view. This attitude is usually due to their lack of experience in dealing with others and to an early environment where many things were done for them and they were given much attention.

The fewer adaptations made for these children in an environmental program the better. Special arrangements mean special treatment which emphasize handicaps.

Suggestions for Working with the Cerebral Palsied Child:

1. When helping a child who is spastic to use his arms or legs, move slowly. If you push or pull a limb quickly it will go into a spasm and your efforts will have been in vain.

2. Avoid hurried and unexpected movements. These may agitate the child and cause his movements to worsen.

3. Do not touch the child without prior warning.

4. Keep the boys who are severe athetoid spastics away from solid objects which may cause them harm due to involuntary waving of their hands.

5. Background music helps the children to relax.

MENTAL RETARDATION

Mental retardation can be defined as slowed development which results in individuals functioning at a lower level than is expected for their chronological age. The level at which an individual functions varies according to the degree of retardation.

These degrees can be broken into four categories:

1) mild, where academic skills and judgment are poor but the handicap may not be immediately apparent;

2) moderate, in which lack of communication skills, poor retention and judgment make the handicap more quickly identifiable;

3) severe, limited verbal skills, lack of understanding and poor gross motor control result in acute limitation in ability to function;

4) profound, limited recognition, and little or no gross motor control result in a lack of awareness of the environment.

According to statistics, most retarded people fall into the mild category.

In the past it was believed that a mentally retarded person cannot learn. This is not true in many cases and in recent years new training techniques have helped these people to develop to their fullest potential.

An environmental program can be a valuable tool in teaching these people, who often have short attention spans and need to be involved with the subject matter in order to learn. The benefits of an interest in nature are numerous. While a retarded individual may have a very difficult time fitting into society, such an individual can find reassurance, impartiality, and many opportunities for self-development in nature. Because so much of nature is concrete and constant it provides an excellent learning ground, providing the person with mental retardation with a subject area he can discuss with anyone.

Suggestions for Working with the Mentally Handicapped:

1. Try to get each child personally involved in the activities. Putting their arms around a tree and maybe sitting on a branch will help them understand a tree.

2. Repetition may be necessary; repeat a step or process over again until he gets the basic idea.

3. Include the retarded child in your initial planning. Ask his opinion about activities.

4. To teach "skills" use "reverse chaining". Present a problem to him that is just one step before completion; teach him that step first, then back him up to the second before the last two, etc., until he gets the total picture.

5. Do not draw attention to his handicap unnecessarily. Expect the same behaviour from him as from other boys.

6. Learn his capacity for doing things by getting to know the boy and offer him program challenges based upon what he can do and understand.

7. Although a mentally retarded child may not be able to speak intelligently, he may be able to understand perfectly what is being said. Ask his teacher or parent.

8. Remember that a mentally retarded child is as sensitive as you. His feelings can be hurt as easily as those with normal intellects.

HEARING HANDICAPS

People, who have hearing handicaps, fit into one of the following three categories:

1) Those who were born deaf or those who became deaf in infancy before their speech patterns had a chance to develop. These people have to be taught not only the meaning of every word but also how to speak each word. They seldom reach a complete understanding of words and their vocabulary is limited. This also affects their ability to read. Unless they have additional handicaps their other abilities are normal.

2) In the second category are those who became deaf after learning to speak. These people usually speak normally and understand words. Their thoughts and imagination are richer than those who were born deaf and they get much more pleasure out of reading.

3) In the third grouping are people whose hearing is defective but functional with or without a hearing aid. These people have fewer problems than those in the preceding groups but they do need special consideration if they are going to function effectively.

Participation in environmental activities is extremely beneficial to these people and there is usually a great deal of enthusiasm on the part of the deaf to join in. Any initial fear or hesitancy on the part of the deaf child to join can usually be attributed to the communication problem. A thoughtful leader can overcome this.

First, find out what levels and types of concepts are understood by the child. Secondly, begin each session with a "sit down" introduction complimented with pictures and explanations of new words and concepts geared to the comprehension level of the child.

In one group, deaf youngsters with a very limited vocabulary were first taught the meaning of words, such as "animals", "trees", "ground" and "plants". These concepts were constantly reinforced. Later the group moved on to more complex concepts such as leaves, differences in trees, rocks, etc. Eventually they examined interrelationships.

The method of communication must be a system understood by the child - spoken for those who are able to lip read, fingerspelled or signed. Fingerspelling (one hand position for each letter of the alphabet) can be learned by a hearing person in fifteen to thirty minutes. Sign language takes longer but a few simple signs can be learned quickly. All "talks" should be supported as much as possible by the written form.

New material must be presented sequentially. It is important that the child should know what is to happen first, second, etc. Deaf

children must have a clear understanding of what is expected of them and what they are being asked to do or they will simply copy each other without understanding what they are supposed to be doing.

Because of the special communication and language needs of a deaf child, groups must be kept small (4-6 children). If a deaf child is mixed with others , then he must be positioned near the speaker.

Suggestions for Working with the Deaf:

1. Make sure the child knows the location of all hazardous areas. Do not assume he has picked this information up in normal conversation.

2. Never blindfold him.

3. The child should sit so that he has a clear full face view of the instructor, who should not be surrounded by unnecessary clutter.

4. Ensure good lighting.

5. Visual aids are important to the deaf and audio-visual aids for the partially deaf.

6. Avoid "asides" for these often are extra "tips" which make learning easier.

7. Begin speaking only after you have attracted the deaf person's attention.

8. Don't mumble words or exaggerate lip movement. Keep hands away from your face when speaking.

9. Don't repeat a word over and over again if the child has trouble understanding it. Many words are difficult to see on the lips. Change the wording and try again. If he does not understand after three tries, write it.

10. Expression by tone will be lost.

11. Expressions by facial characteristics assume a greater importance and care should be taken.

12. Hide laughter because of a "funny" situation arising from a failure to hear.

13. The hard-of-hearing or deaf child can be quite lonely because of his communication problem. Encourage the child to participate in the program as much as possible.

14. Deaf people are sometimes assumed to be "dumb" because of their limited vocabulary. This is a terrible misconception.

Additional Comments:

1. An environmental education program for six to nine year old deaf children should stress the development of concrete observational skills and provide opportunities for the child to become directly involved in discovering and understanding the world around him. The activities should involve weighing, measuring, seeing changes and looking for similarities and differences.

2. A program for children nine to twelve years old should emphasize the growth of organizational and reasoning powers. This is a good age to encourage report writing. At this stage, deaf children usually develop a growing awareness of their isolation and tend to become the more passive members of the group. Leaders should try to combat this by encouraging active involvement in all activities.

3. A major problem for an environmental education program for deaf children above the age of 12 is that the children are interested in topics appropriate to their age but their reading skills are often inadequate. This is also the reason why the rate of progress in completing a project is slow. Leaders should be prepared to offer assistance when necessary but be careful not to take over or rush the work.

REFERENCES

1. Beechel, Jacque. "Interpretation for Handicapped Persons" in Journal of Environmental Education 6:4 Summer '75.

2. Girl Guides of Canada. Guiding for the Handicapped. 1972.

3. Leitman, Allan. Science for Deaf Children. New York: The Alexander Graham Bell Association for the Deaf, Inc. 1968.

4. Macomb Intermediate School District. Discovery Through Outdoor Education. Michigan, 1977.

5. The National Council of Boy Scouts of Canada. Scouting for Boys with Handicaps. 1976.

6. National Science Teachers Association. A Working Conference on Science Education for Handicapped Students. Proceedings. Washington, DC. 1978.

7. Zolomij, John. "Special Education Report on Activities Being Carried Out With the Deaf and Hard of Hearing Class at Mt. Penn Special Education Unit." Reading, P.A.: Environmental Education Centre, Nolde Forest State Park, 1973.

Air Quality

AIR MANAGEMENT

AIR

Air is a gas that surrounds our planet and is essential for all life. Take a deep breath and hold it. Look at the second hand of your watch. How long can you hold your breath? Scientists say that no one can last more than 10 minutes without taking a breath.

Activity I

To show that plants need oxygen.

Equipment: - a house plant
- vaseline

1. Spread a thin layer of vaseline over the tops and bottoms of four leaves of a house plant. (The vaseline prevents air from reaching the leaves.)

2. Examine the leaves the following day. You will find that the coated leaves have lost their color and are beginning to wither.

3. Wipe the vaseline off two of the leaves. If you do it soon enough, the leaves will start to breathe again. They will regain their green color and normal appearance.

4. Observe what happens to the leaves you leave covered in vaseline.

Air is composed of atoms which are always in motion. (Atoms which are combined are called molecules.)

Activity II

To show that the molecules in air are always in motion.

Equipment: - paper towel

- match

1. Roll up the paper towel and light one end with a match. Let it burn for a few seconds and then blow out the flame.

2. What happens to the smoke?

(Note: The moving molecules in the air bump into the particles of smoke and scatter them in all directions so that it cannot be seen at all.)

The air has no color. Yet when we look at the sky on a clear day, it appears blue.

It is because we get most of our light from the sun, which sends out light rays of all colors. As these rays approach the earth, they bump into the molecules and particles of dust in the air, which force the rays back out into the atmosphere. Blue light waves vibrate much more quickly than do the other colored waves so they have more collisions with molecules and are sent out in all directions.

That is why the sky looks blue on a clear day, no matter which way you face. The yellow and red rays which have fewer collisions come almost straight down to the earth making the sun look yellow-red.

AIR POLLUTION

Air pollution is air which has become impure or unclean because contaminating substances - smoke, gases, and dust - have been added to it.

A small part of the world's air pollution is the result of natural causes - volcanoes, forest fires, earthquakes and the natural decay of trees, plants and animals.

However, the major sources of air pollution stem from man's activities - motor vehicles, heating and power plants, factories, waste disposal and other miscellaneous causes.

Air pollution can reduce visibility, destroy plants, soil buildings and clothing and endanger health. To show how air pollution affects clothing, see Activity III.

Everyday the news media issue A.P.I. readings. A.P.I. means air pollution index. The readings tell you how much pollution (sulphur dioxide and particulate matter) is in the air.

All readings below 32 are acceptable.
0 - 32 - little effect on people.
58 - people with severe respiratory problems could be affected.
100 - if it is this high for a long period of time, healthy people could be affected.

Does the government take any action when the index reaches a high level?

When the index reaches 32 and the weather is expected to remain the same for at least 6 hours, the government (through the Ontario Ministry of the Environment) tells the owners of companies which are major sources of air pollution that they may have to shut down their operations. This is called the advisory level.

32 - advisory level
50 - some companies are ordered to shut down
75 - more companies are ordered to shut down
100 - everything not essential to public health and safety is shut down

Because of the early steps, the index is unlikely ever to reach 100. The highest reading ever recorded in Ontario was in Welland on October 6, 1974. The index reached 76.

Activity III

To observe how air pollution affects clothing.

Equipment: - two empty tin cans
- nylon stocking
- rubber bands
- magnifying glass
- paper and pencil

1. Cut two pieces of nylon from the stocking and cover the tops to the cans with them. Hold the nylon in place with the rubber band.

2. Put the cans under a magnifying glass and draw a picture of how

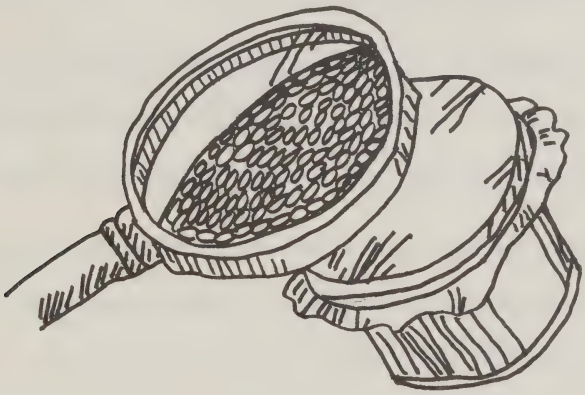
the threads in the nylon look.

3. Then place one can outside where it will not be disturbed but keep it away from any walls. Keep the other can indoors.

4. After 30 days, examine both cans again under a magnifying glass. Redraw a picture of the threads.

5. Compare it with the old drawings.

6. Can you detect any changes in the nylon? Do you know what caused these changes?



Activity IV

To count particles in the air.

Equipment: - 10 index cards
- white masking tape
- scissors
- paper and pencil

1. Number the cards from 1-10.

2. Cut 10 strips of tape 4" long. Fold the two ends of the tape

back and fasten one to each index card so that the sticky side faces out.

3. With additional tape attach each index card to the outside and inside of five windows. (Try to use windows facing in different directions, overlooking various activities: road, yard, garden etc.)

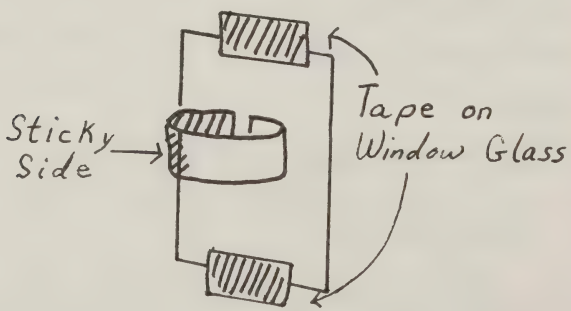
4. Make a chart, using the following titles for columns: card number, location and number of particles.

5. After two days collect the cards.

6. What are the differences between the cards left inside and those outside? Do the cards which face a road have more particles on them than the cards facing the yard? Why?

7. Mark off a ¼-inch square near the entrance centre of each piece of tape. Using a magnifying glass, count all the particles you can see in the marked off square.

   (Note: if there are 15 or fewer particles, the air is clean; if more than 100 particles, the air is badly polluted.)



Activity V

To prove that auto exhaust contains particles.

Equipment: - index cards
- tape
- scissors
- car
- pencil and paper

1. Attach a strip of paper to an index card in the same manner as in Activity IV.

2. Hold the card about one foot from the tailpipe of a car that has its motor on but is parked.

   (Note: This experiment should be done out of doors, not in a garage.)

3. Write up your experiment. Include the make and year of the car, the date of the last tune-up, the type of gasoline used (regular or lead-free) and the number of particles on the card.

4. Repeat the experiment with other cars' exhaust.

5. Try the experiment before and after a car has been tuned up.

6. See if there are any differences between cars that use regular gasoline and those that use lead-free.

7. What conclusions can you come to? How important is the age of the car? The make of the car? The date of the last tune-up? The type of gas used?

Activity VI

To demonstrate the effects of temperature on air pollution.

Equipment: - large glass jar or aquarium
- ice cubes
- rubber tube
- lit cigarette

1. Chill the bottom of the jar with ice cubes for about ten minutes.

2. Set the jar upright so that the chilled bottom rests on a table.

3. Insert one end of the rubber tube into the jar so that it rests on the bottom.

4. Gently inhale smoke into the bottom of the aquarium.

5. Record what happens.

(Note: The smoke should remain concentrated on the bottom for some time as the temperature increases with height, that is the cooler air is on the bottom and the warmer air on top - a temperature inversion.)

6. While the bottom of the jar is still cold, invert the jar so that the chilled bottom is now the top of the jar.

7. Slip the rubber tupe uder the side of the jar and again blow smoke into the jar just over the table. Quickly remove the tube.

8. Record what happens.

(Note: The exhaust from an automobile contains both gases and particles that pollute the air. The gases are carbon monoxide, hydrocarbons, and nitrogen oxides. Most of the particles are of the metal lead. Lead is added to gasoline to make the car run more smoothly.

AIR POLLUTION AND WEATHER

Much of the time, the air nearer the ground is warmer than the air higher up. The warm air rises, carrying any pollution with it and the cooler air drops down, to be warmed and to rise in its turn. Winds also help to move or disperse pollution.

Sometimes, warm air forms above an area and the cooler air is trapped below it and cannot rise. This is called a temperature inversion. There are only weak breezes to move the pollution around, which is already in the air. In addition, on the ground we are carrying on with our activities as usual and adding more pollutants to the atmosphere. This leads to a serious build up of pollution and requires positive action on our part to prevent an unhealthy situation from occurring. (See section on air pollution index.)

(Note: In this case, the smoke should mix rapidly throughout the whole depth of the jar because the cold surface is on top causing a rapid temperature decrease with height.)

ADAPTATIONS

For the Mentally Handicapped:

Visual aids are useful tools for explaining environmental topics to the mentally handicapped. In this section, pictures or diagrams which show sources of pollution - smoke coming from factory and home chimneys, smokey exhaust from cars, etc. - are extremely helpful.

With some youngsters it may be easier to establish the idea of air by having them hold a hand in front of their mouths and blowing rather than by holding their breath. Air movement can be demonstrated by blowing a ping pong ball around a table.

For the Deaf:

Air and water are two physical phenomena that lend themselves easily to new observational experiences for the young deaf child.

Give each child a plastic cup, a basin or pail, some tubing, a syringe and straws. How many ways can a child find to transfer water from the basin to the cup using the materials he has been given? How many ways can be found to fill the cup with water if it is upside down in a pail filled with water? (Try drawing the air out of the cup with tube or syringe). How many ways can a cup full of water be emptied? Use balloons, large pails, cups, water and tubing to explore the properties of air and water.

For the "Special" Youngster:

See information for special youngsters in Weather Section.

Astronomy

ASTRONOMY

Astronomy is the scientific study of the heavenly bodies, their motion, relative positions and nature. Obviously, it is impossible to include in this one short chapter all the information and exciting activities that you can undertake with regard to our night sky. The few projects listed here are just to whet the appetites of both leaders and their groups of youngsters. Happy star gazing!

THE SUN

The sun is a star - that is, a heavenly body that gives out light and heat on its own. It is the center of our solar system and it is what makes life on earth possible.

Our solar system consists of nine planets and a belt of asteroids (minor planets) all revolving in elliptical orbits around the sun.

Planets	Diameter		Distance from the Sun in millions		Sidereal period (the year of a planet*)
	Kilometres	Miles	Kilometres	Miles	
Mercury	5,100	3,194	58	36.	88.0 days
Venus	12,600	7,842	108	67.1	225.0 days
Earth	12,750	7,926	150	92.9	365.26 days
Mars	6,830	4,263	230	141.7	687.0 days
Jupiter	143,000	89,229	780	483.4	11.86 years
Saturn	120,000	74,937	1430	886.1	29.46 years
Uranus	53,500	33,181	2090	1782.7	84.0 years
Neptune	49,000	30,882	4500	2793.1	164.8 years
Pluto	5,800	3,600	5900	3666.1	248.8 years

* The actual period of revolution around the sun.

Planets	Diameter		Distance from the Sun in millions		Sidereal period (the year of a planet)
	Kilometers	Miles	Kilometers	Miles	
Sun	1,390,000	864,100	-------		-----
Earth's Moon	3,450	2,159.9	0.375	0.239 (to Earth)	27.32

ACTIVITY I

To build a scale model of the planets in our solar system.

Equipment: cardboard
tape or pins
large wall

Cut discs from the cardboard the same diameter in size as indicated in the following chart. Fasten them to the wall the same distances apart as indicated in the chart.

Body	Diameter		Distance from the Sun	
	cm	inches	cm	inches/feet
Sun	68	27	--	--
Mercury	0.3	1/8	4.5	1 3/4"
Venus	0.6	1/4	8.3	3 1/4"
Earth	0.6	1/4	12.2	4 3/4"
Mars	0.3	1/8	18.0	7"
Jupiter	7.0	2 3/4	61.0	2'
Saturn	6.0	2 3/8	120.0	3' 8"
Uranus	2.5	1	225.0	7' 5"
Neptune	2.2	7/8	355.0	11' 8"
Pluto	0.3	1/8	465.0	15' 3"

A label could be attached to each giving the body's name and actual size. A piece of cardboard with many small dots representing the asteroids could be attached to the wall halfway between Mars and Jupiter.

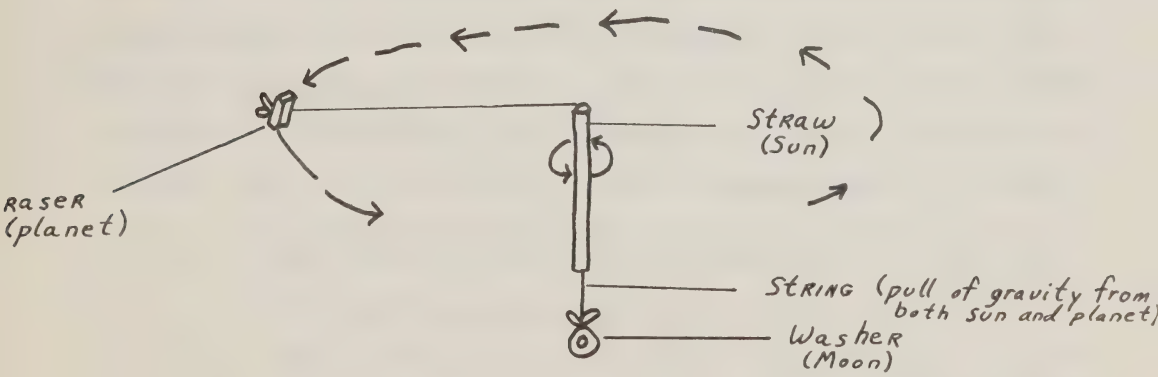
The earth and three other planets - Jupiter, Saturn and Neptune all have their own moons, which revolve around the planet rather than the sun.

ACTIVITY II

To demonstrate why planets revolve around the sun and the moons revolve around the planets.

Equipment: drinking straw
eraser
large nut or washer
piece of string

Pass the string through the straw and tie the eraser to one end and the washer to the other. Twirl the straw so that the rubber will whirl around in a circular path and the washer will hang downward. Increase the speed at which the eraser is moving by twirling the straw faster. Observe what happens to the washer.



BACKGROUND INFORMATION:

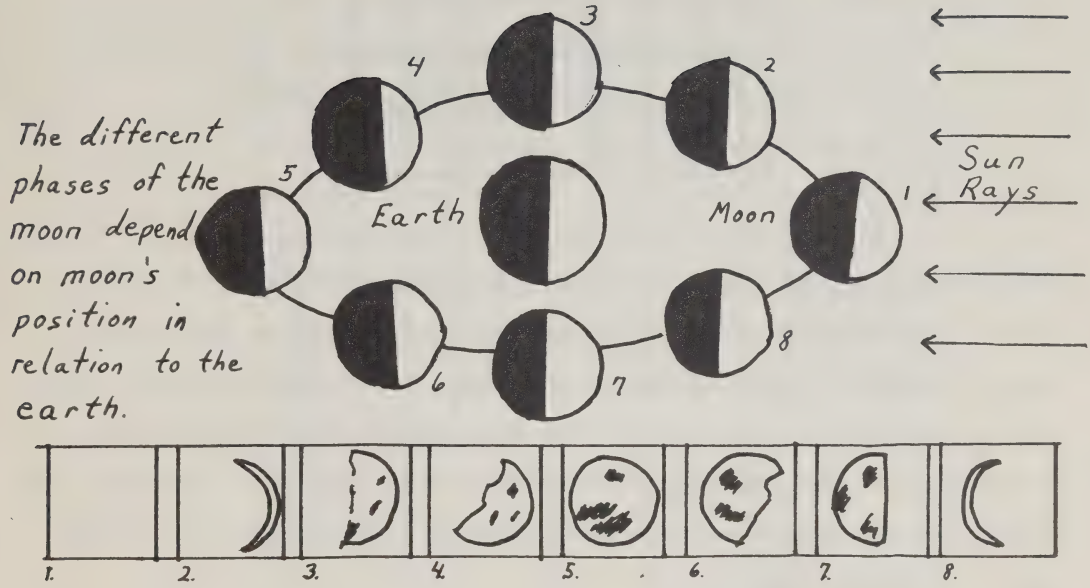
The straw represents the sun and the eraser a planet. The washer and string represent the pull of gravity of both the sun and the planet combined. By increasing the speed of the rotating eraser the

washer moves upward showing that the pull has been increased, and the object is now travelling in a different path. As long as the speed and pull remain constant the object continues to rotate in the same path or orbit. The same thing is true for the moon and the earth.

THE MOON

A moon is a satellite - a dead mineral mass with no light of its own. The earth's moon travels around our planet in a nearly circular path at an average distance of about 380,000 km or 239,000 (100 times the Atlantic Ocean) miles from the earth at a speed of about 50 km per minute or 30 miles per minute. It takes four weeks for the moon to completely circle the earth.

Moonshine is only reflected sunshine. The sun always lights up half of the earth's moon but because of the different positions of the earth and the moon we only see fully illuminated at full-moon time. When the moon is directly between the earth and sun, we can see only its shadow side. This is called the new moon or the dark of the moon. Then, as the moon slowly circles around the earth, it reveals a crescent-shaped edge of its sunlit face. After about a week we can see a full half of the sunlit face, which we call the half moon.

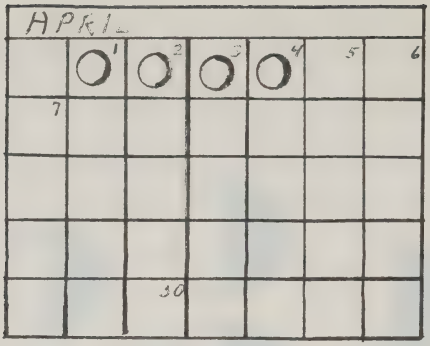


ACTIVITY III

Making a moon calendar.

This is a long term study which should be carried on for at least a month.

Rule off a large piece of bristol board so that it will correspond to the calendar for that month. Number each square according to the date. Observe the moon at an identical time each night and sketch the appearance of the moon in the appropriate square of the calendar. Use a complete circle and shade in the darkened portion.



The surface of the moon is probably dark brownish rock and lava. Wide, relatively dark plains on the moon are known as maria, or seas but they contain no water. At the edge of some of these maria, are high mountain peaks which rise to heights of 8 kilometres or 26,000 feet. The moon also has thousands of craters. From some of these craters bright streaks, called rays, spread out across mountain and plain alike.

ACTIVITY IV

Mapping the moon's surface.

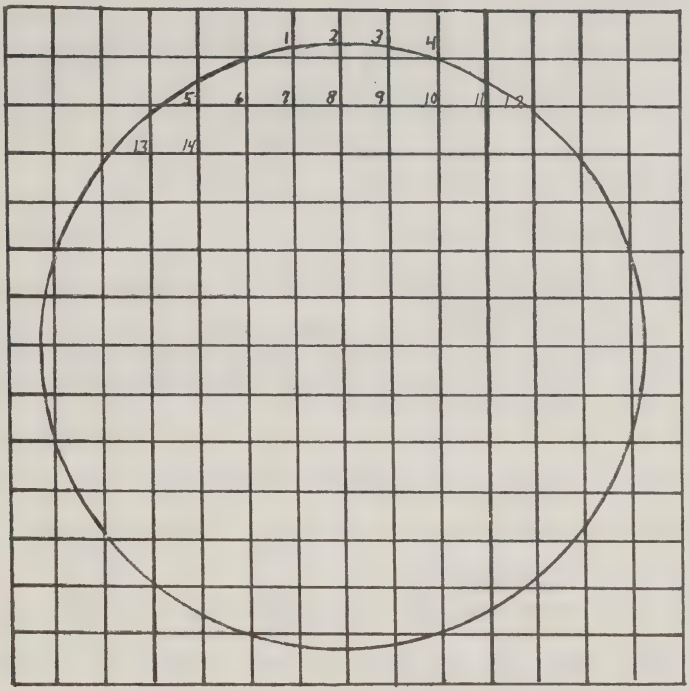
This activity is easier to do when the moon is full.

Equipment: ruler
bristol board
string, thumb tack and pencil or compass
binoculars or telescope

Using the ruler, make a grid of 15 cm or 6" squares on a large piece of bristol board. With the compass, or string, tack and pencil draw a large circle on the grid.

Number the squares that appear inside the circle. With the binoculars, observe and sketch on the bristol board, the markings of the moon which would be found on a particular square.

Use an encyclopedia to label the main features - mountain ranges, craters, seas, etc.



ACTIVITY V

Duplicating the surface of the moon.

With paper mache or a mixture of salt and flour, construct a map of the surface of the moon and paint it when it is dry.

Paper mache (for modelling)

Tear up newspapers into small bits. Soak in water (at least overnight). Stir until a pulp and then drain off any excess water. Add some powered paste. Stir thoroughly and then build up the forms.

Salt and Flour (for maps)

1 part salt

1 part water

Add enough water to make the mixture stick together. Keep hands well floured when working with this.

ACTIVITY VI

Examining the moon's color.

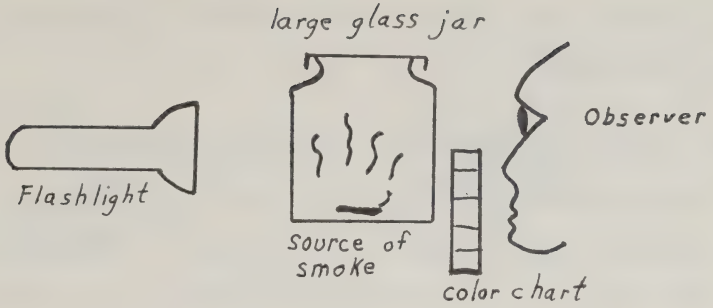
Equipment: large glass jar
a flashlight
cloth covered in chalk dust
color charts from a paint store which show a gradual change from white to grey, to yellow, to orange, to blue and to red

1. Look at the face of a lighted flashlight and use the color charts to find the shade which matches it most closely.

2. Shine the light through the glass and use the color chart to find the color of the face of the flashlight again.

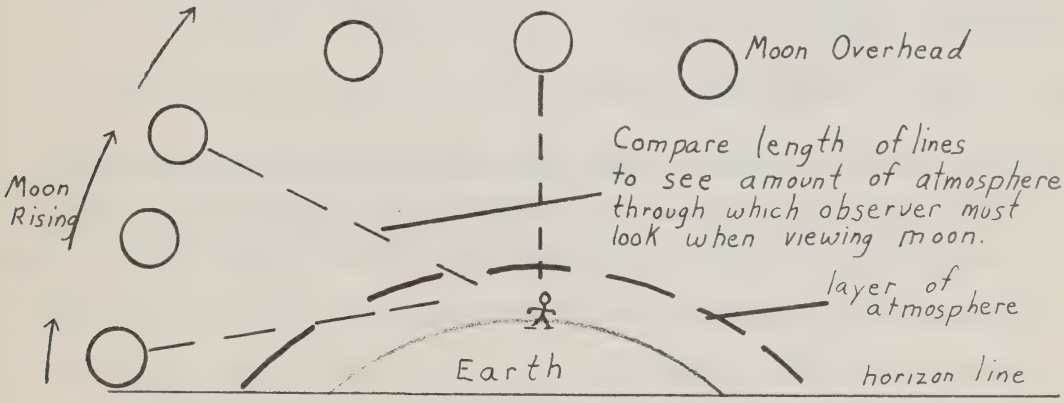
3. Place some chalk dust in the jar by shaking a rag, which has been used to clean a blackboard, inside the jar. Repeat the test with the flashlight and color charts.

4. Place smoke in the jar either from smouldering string or a burning cigarette. Repeat the test with flashlight and color charts.



BACKGROUND INFORMATION:

The moon's color only appears to change. The more air that one must look through the darker the color of the moon appears. In addition, as more impurities are added to the air, (i.e. pollution) the color becomes darker.



THE CONSTELLATIONS

Although our sun is immense as compared to the planets in our solar system it is only a minor star among the billions of stars in the universe. Some of the stars seem to form patterns in the night

sky. These patterns are called constellations. There are about 90 named constellations.

If the earth turned completely on its axis once very 24 hours, we would see the same constellations every night in our sky. However, the earth actually completes its turn in every 24 hours and 56 minutes. This means that the constellations rise 4 minutes earlier very night -- two hours a month, six hours a season and 24 hours a year. Therefore, if you watched the sky at the same time every night for a year, you should be able to see all the stars visible in your location.

ACTIVITY VII

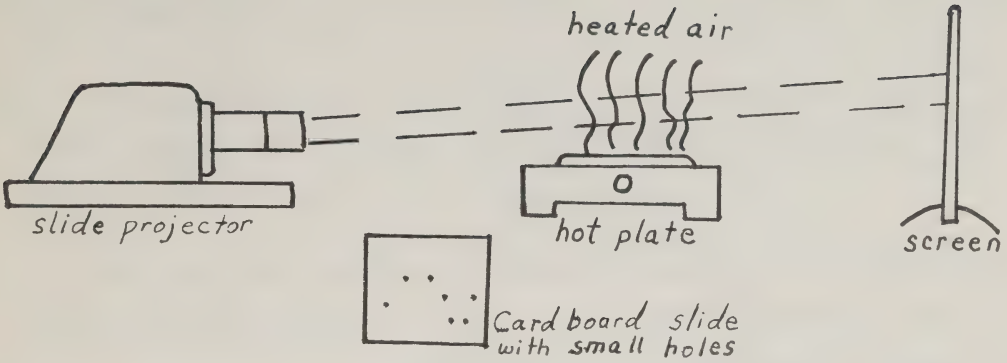
To demonstrate why stars seem to twinkle.

Equipment: slide projector
hot plate
bristol board
screen, blank wall

1. Cut a piece of bristol board, the same size as a slide and punch some small holes through it. Insert board in projector. Focus the projector so that small round dots clearly appear on the screen. Place the hot plate between the projector and the screen as the hot plate warms up the air.

BACKGROUND INFORMATION:

The heat from the hot plate warms the air and causes it to move, making the image move or twinkle. In a similar manner, light from the stars passes through a layer of air around the earth which has been warmed by the heat energy from the sun.



ACTIVITY VIII

To demonstrate why stars have different colors.

Equipment: propane torch
paper clip
rubber eraser

1. Straighten the paper clip and insert one end in the eraser.

2. Heat the other end of the paper clip in the flame of the torch.

3. Observe its color after each successive small interval of heating time.

BACKGROUND INFORMATION:

The wire changes from red to orange to yellow as it is heated for longer periods and becomes hotter.

Some star colors and their approximate temperatures are:

Star	Color	Temperature
Rigel	blue - white	36,000 F plus
Procyon	yellow - white	13,500 F

Star	Color	Temperature
Sun	yellow	11,000 F
Arcturus	orange	7,500 F
Antares	red	5,500 F

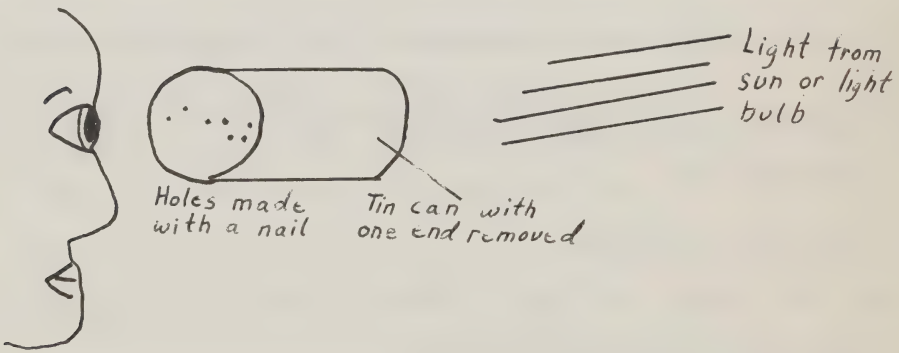
ACTIVITY IX

To make a constellarium.

Equipment: flashlight or a light bulb
tin can with top removed or small cardboard box

1. With the help of reference books, punch holes in the tin can or box to represent the star pattern of a constellation. Use a different container for each constellation.

2. Hold the box up to the light.



ACTIVITY X

To construct a simple planetarium.

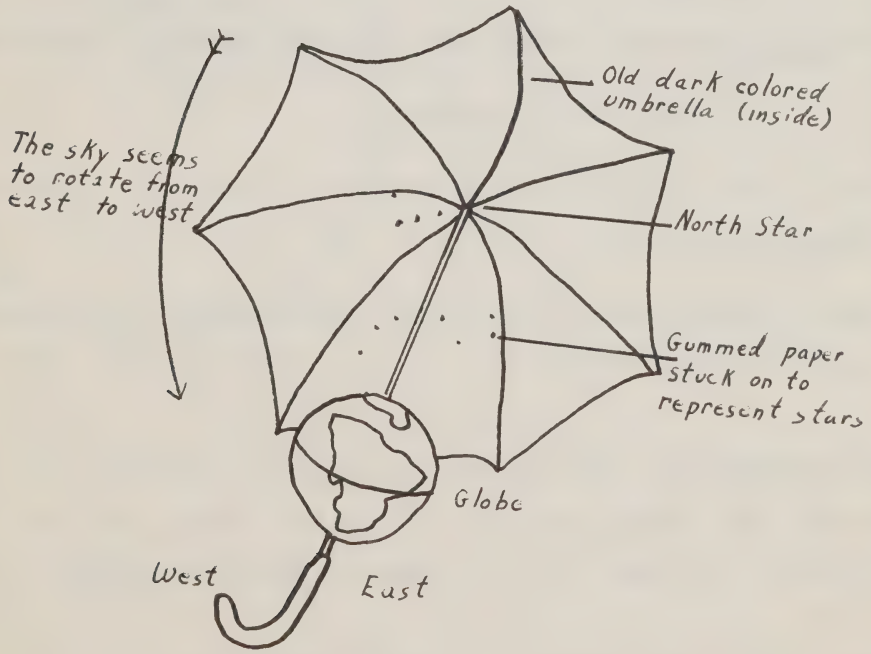
Equipment: old umbrella - dark in color
globe
small circles cut from gummed paper

1. Let the inside tip of the umbrella where the ribs converge be the north star.

2. Glue the small circles onto the side of the umbrella to represent as many of the other stars as possible. (It will be impossible to include all the constellations).

3. By revolving the handle of the umbrella you can see the rotation of the constellations.

4. Remove the handle from the umbrella so that the rod can be inserted through the holes at the poles of the globe. You can now see the position of the constellations in relation to the earth.



ACTIVITY XI

Building a star chart.

Equipment: ruler
pencil
large sheet of paper
paints or crayons
plywood circle
nail, hammer option
luminous paints
star map *

1. With pencil and ruler, draw 10cm or 4" squares on large sheet of paper to correspond to squares marked on a star map. You may have to square off the map yourself. (Choose either the summer or winter sky).

2. Using squared star map as your guide, mark on large sheet the positions of all the stars.

3. Erase pencil marks; color stars and draw lines for constellations.

or after completing step 2

3. Place sheet of paper on plywood circle. Use nail to punch star marks into board.

4. Remove paper. Paint stars with luminous paint. Draw lines for constellations.

ACTIVITY XII

Exploring the stars.

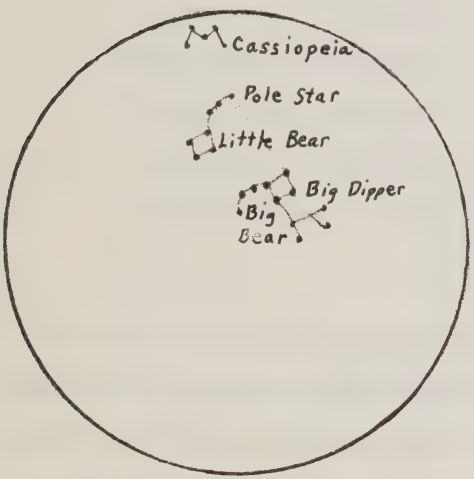
Equipment: star map * (either summer or winter depending on the season)

1. Begin your explorations by locating the Big Bear.

2. Locate the part within the Big Bear constellation that we call the Big Dipper (4 stars make up the bowl and three the handle).

3. Now draw an imaginery line between the two stars of the bowl farthest from the handle and continue this line until you hit the polestar. The polestar is also called the North Star and is the first star on the handle of the Little Dipper.

4. Next, locate on the opposite side of the polestar the W-shaped Cassiopeia.



The Summer Sky

The Winter Sky

If you know the positions of the Big Dipper and Cassiopeia you can easily find some of the other major constellations.

Spring

Leo, the Lion or the Sickle

Auriga, the Charioteer

Gemini, the Twins

Corvus, the Crow

Cancer, the Crab

Winter

Orion, the Hunter

Canis Major, Big Dog

Canis Minor, Little Dog

Taurus, the Bull

The Plaiades, Seven Sisters

Lepus, the Hare

Aries, the Ram

Cepheus, Andromeda's Father

Cassiopeia, Andromeda's Mother

Summer

Lyra, the Lyre

Cygnus, the Swan

Scorpio, the Scorpion

Aquila, the Eagle

Bo tes, the Herdsman

Corona Borealis, the Northern Crown

Draco, the Dragon

Serpens, the Snake

Fall

Andromeda, the Maiden

Pegasus, the Horse

Perseus, the Knight

Hercules, the Hunter

These constellations shift a little each night so their position in the sky changes. The relationship of one constellations to another, however, always remains constant.

Note: When pointing out stars or constellations at night use a flashlight with a strong beam whose lens has been covered with red cellophane.

If you are particularly thorough in your study, you may occasionally find a couple of stars not indicated on the map. They would not be

real stars, shining by their own light but planets shining by light reflected from the sun. Depending on the time of year and the time of night, you might be seeing Venus or Jupiter, Saturn or Mars. You can easily check in an almanac what planets are supposed to be in the sky at the time you are watching.

* Star maps may be obtained from the Bookstore at the Royal Ontario Museum, 100 Queen's Park Crescent, Toronto, Ontario M5S 2C6, for $1.95. Mailing charges are extra.

ADAPTATIONS

For the Physically Handicapped:

When teaching a session on the revolution of the earth around the sun a student confined to a wheelchair can be wheeled around in a circle along with the other students who will take the paths of other plants.

On a warm summer night lay the youngsters outside on blankets and ground sheets to gaze at the stars.

For the Blind:

A lesson in astronomy involving the cause of day and night and the rotation of the earth can be taught to the blind with the use of a heat lamp. The student turns (counter clockwise as the earth does) while the lamp is directed toward him. The lamp represents the sun.

To explain the constellations to a blind child, it has been found that a commercial map of the stars glued to a cork board has been extremely beneficial. Place map pins in the starts of the major constellations and then wrap heavy thread around the pins to outline each constellation. The finished product is useful for both blind and sighted individuals.

For the Deaf:

The most effective method found to date for explaining the constellations to deaf children has been to use 35mm slides with captions as each constellation outline was projected.

To assist the youngsters in building a concept of the earth's movement on its axis around the sun, try this procedure: stand a broomstick in a sunny place where it won't be disturbed. Using chalk, mark the ground where the top of the broomstick's shadow lies. Repeat the markings at different times during the day for a number of days. Discuss why the shadow moves from moment to moment and differs from month to month.

An indepth study of astronomy is difficult with some groups of deaf youngsters due to the many complex abstract ideas involved. However, some youngsters do find it genuinely interesting. Activity I, which involves scaling, offers a good opportunity to improve measuring skills.

If working with older, deaf youngsters give them the actual sizes of the astronomical bodies and their distances from the sun and have them try to find a proper scale that will allow them to suspend models of all planets in a hallway without bunching some up or leaving out the outer ones.

For the Mentally Handicapped:

Pictures and diagrams are essential here. Before naming the constellations show a picture depicting the name. For example, many of these youngsters will recognize a picture of a "dipper" faster than they will the word.

Star-shapes cut from cardboard and hung with tacks and different lengths of string from the ceiling is another useful teaching idea.

Instead of the cardboard stars you could also use lighter-than-air balloons, moving them into the position of the constellations. The youngsters could also blow air at the balloons to show star movement.

Birds

OBSERVING BIRDS

BACKGROUND

Any animal with feathers is considered to be a bird. The feathers provide the bird with protection from the elements. The outer features keep the bird warm while in the summer the flat feathers next to the body keep it cool.

Not all birds can fly. The ostrich's wings are too small to lift it into the air but as it feeds on grass, it doesn't need to fly around looking for food. The same is true for chickens on a farm, which are fed corn by the farmer.

A bird's protective coloring helps it to survive by protecting it from its enemies. In many species, the male is more colorful than the female. This is because the female usually spends more time sitting on the eggs and protecting the young birds than does the male. Her duller coloring helps her to blend into the background so that she is more difficult to see and capture.

The old saying "to eat like a bird" does not really mean to eat sparingly for nothing in the animal kingdom eats as much or as frequently as do birds. They spend most of their days eating or searching for food for themselves or their young.

If you look closely at a bird's bill, feet, tail and wings you can learn a lot about his habits and eating preferences.

For example, the woodpecker's strong chisel-shaped bill is adapted for chipping wood as a means of boring into trees in search of grubs. Its feet have two sharp toes pointed forward and two back-

ward which clamp the bird securely to the tree trunk in an erect position. Sharp-pointed tail feathers act as props to steady the woodpecker while it uses its bill as a hammer.

ADAPTATIONS:

Bills of birds are variously adapted for procuring foods and serve also for nest building, preening feathers and for protection.

Feet are built for perching, scratching, walking, swimming and for seizing prey.

Wing size and shape vary greatly. Some wings are designed for soaring, for sudden turns and rapid flight for easy long travel.

Tails provide balance when perching and flying; are rudders during flight.

See diagrams on adaptations at the end of this section.

ACTIVITY I

Build and put out nesting boxes for birds.*

Even a small home garden can become a habitat for birds - meeting the four basic requirements for wildlife:

1. Cover - provided by trees, shrubs, etc.
2. Food - provided by feeding stations, and the growing of flowering plants, fruits, berries, etc., plus the insect life in the vicinity
3. Water - provided by ponds, birdbaths
4. Living space - provided by natural nest-making facilities, and/or artificial nests, plus the total environment.

Included at the end of this section are a few illustrations of nesting designs for various kinds of birds.

When making and putting out nesting-boxes in your garden, or camp here are a few points to remember.

- Make sure that the boxes are firmly attached.
- Do not put nails in valuable trees. Nails can cause serious damage to a tree. Fasten the boxes without damaging the tree.
- Tilt the box slightly forward, to prevent the rain from getting in; and make sure the box is not leaky at the joints.
- Face the entrance hold on the lee side, away from the prevailing wind.
- Do not put perches outside the entrance hold - perches are of use only to those animals that want to eat the bird and its eggs or its young.
- Clean the boxes once a year - at the right time, when you are sure that the bird has abandoned its box. Remember that when the birds migrate, they'll usually come right back to their old box on their return. If you are in doubt, don't clean the box at all. Some birds, of course, will remain all year round.
- Ask the permission of the landowner before putting up nesting boxes.

ACTIVITY II

Set up and maintain bird feeders and birdbaths.

This is good service to wildlife all year round, but especially during times of drought, and during the winter. In winter, feeding should start early to attract the birds. Once started, it must continue until spring--because the birds depend on the food supply, and if it stopped suddenly, when their natural supply is still scarce they may die before they can find food elsewhere. The foods birds like include suet (beef fat); bread crumbs; sunflower seeds;

crushed corn (maize); chicken feed; hemp seed; millet seed; squash seed; crushed nuts; and even peanut butter. For the fruit eaters, in your wildlife habitat, you can grown strawberries, blackberries, gooseberries, mulberries, etc. - whatever is appropriate to your locality. They'll eat them straight off the growing plant. Locate your feeding and drinking stations near to a tree, shrub or bush - birds need nearby cover when larger, predatory birds like crows or kestrels or hawks are in the area. Locate feeding and water station where cats and dogs cannot reach the birds.

GAME

Battle of the Beaks

Different species of birds eat different things. Some birds prefer insects, some like grain, others are nectar-eating. The beaks of all birds are adapted to help them obtain the type of food they need. (See adaptations of bills chart).

Equipment: strainer or small fish net
spoon
pliers
scissors
tongs
meat baster
small beans

Activity:

Scatter the beans on a table top, on the carpet, float some in water, bury some in sand and glue some to a board.

Object:

Using the various tools, have the youngsters try to pick up the

beans. Describe the various types of bird beaks and have children try to match each tool to a bird beak. For example, the meat baster will be useless in picking up beans and this frustrates a child but then imagine how a hummingbird would feel trying to eat a bean.

Discuss how an area would need a variety of food sources to support different types of wildlife.

Adaptations of Bills:

1. Seed-eating - a) short, thick bill for crushing seeds. Examples: sparrow, grosbeak, bunting, finch b) upper and lower mandibles crossed to enable bird to extract seeds from cones of evergreen trees. Example: crossbill.

2. Insect-eating - slender, pointed beak for picking up insects. Example: warbler.

3. Probing - long, slender bill for probing mud in search of food. Examples: snipe, woodcock, sandpiper.

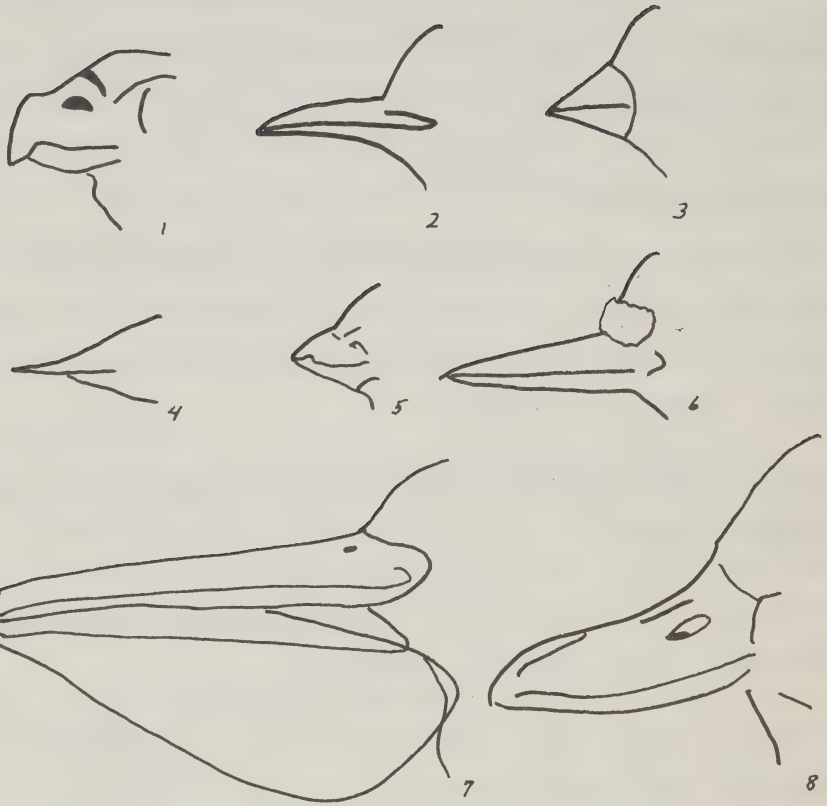
4. Preying - strong, sharp hooked bill for tearing flesh of prey. Examples: owl, hawk, falcon.

5. Straining - broad, flattened bill for straining food from mud. Examples: flamingo, duck, goose

6. Ground-feeding - short, stout bill for feeding on the ground, as a hen. Example: bobwhite

7. Fish-eating - a) long and sharp for spearing fish. Example: heron.

b) with a flexible pouch underneath bill for holding captured fish. Example: pelican.



Adaptations of Feet:

1. Perching - three toes in front, one toe behind. Most familiar birds are of this type. The foot automatically clasps the perch when the leg is relaxed. Examples: sparrow, chickadee, robin.

2. Wading - long legs, long slender toes. The three long toes keep bird from sinking into the mud. Examples: heron, sandpiper.

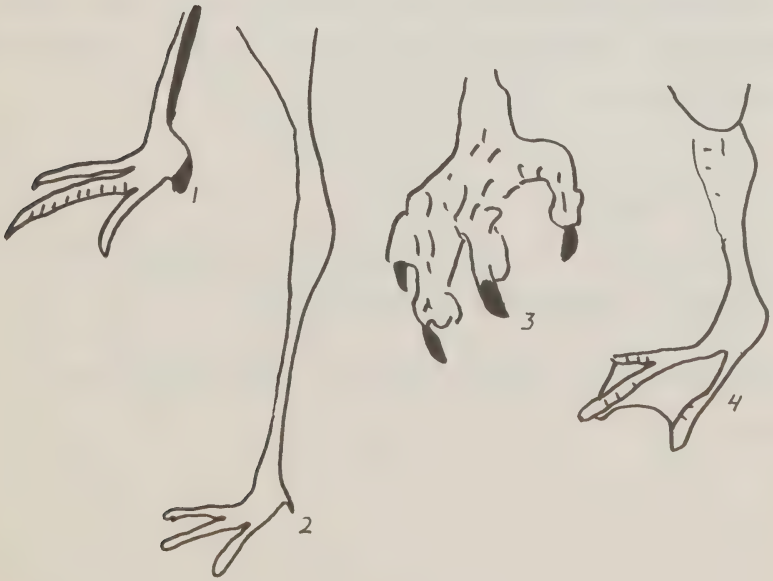
3. Preying - powerful feet and legs with strong, curved, sharp talons for grasping prey. Examples: hawk, owl, eagle.

4. Swimming - three front toes fully webbed. Examples: goose, gull, duck.

5. Climbing - two toes in front, two toes in back; sharp claws for clinging to an upright surface with ease. Example: woodpecker.

6. Scratching - claws strong and blunt for raking or scratching the ground for food, as a hen. Example: pheasant, quail, grouse. (Foot is similar to that of a climbing but number of toes may differ).

7. Living in snow covered region - feathers are used to support the weight as well as help keep the foot warm.



Adaptations of Tails:

1. Tail feathers with strong spine-like tips for use as a prop of support when clinging to vertical surfaces. Examples: woodpecker, swift.

2. Broad, fanned tail for soaring. Example: hawk.

3. Long, forked tail for graceful, skimming flight and extreme maneuverability. Examples: tern, barn swallow, frigate bird, swallow-tailed kite.

Adaptations of Wings:

1. Long, pointed wings for fast, easy flight in the pursuit of flying insects. Examples: swallow, swift.

2. Long, broad wings for strong soaring, effortless flight. Examples: hawk, eagle.

3. Short, rounded rings wings for speedy take-off and fast flight over comparatively short distances. Examples: sparrow, quail, pheasant, woodcock and grouse.

Chart 32. From International Show-and-Do Conservation Project Kit by World Scout Bureau/World Wildlife Fund.

BIRD IDENTIFICATION

When bird watching, you may find that the bird does not stay in sight long enough for you to find it in an identification book. To assist you, therefore, the following data sheet has been prepared. Using the preceeding three pages as a guide, fill in the form and then take the time to find the bird in a nature book.

DATA SHEET

SIZE A

SHAPE

General B

Bill Shape C

Tail Shape and Markings D

SIGHT

Main Color

Special Markings E

FEET F

SPECIAL HABITS

FLIGHT PATTERN

Description

Sketch

Name of Bird

Site

Prepared by the staff of the Kingfisher Lake Outdoor Education Centre, Thunder Bay, Ontario.

A SIZE

SPARROW SIZE
5¼" TAIL TO BEAK
(13 cm)

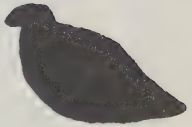
ROBIN SIZE 8½"
(31 cm)

CROW SIZE
(43 cm)

Estimate the size of the bird you are observing -- is it smaller than a sparrow? Larger than a sparrow but smaller than a robin? Express approximate size in cm.

B GENERAL BODY SHAPE

chunky as a meadow lark



plump as a grouse

slender as a swallow

downright bulky as an owl

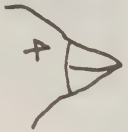
Does the shape of the bird that you are observing compare with any of the above? If not use words that you think describe the shape of the observed bird.

C BILL SHAPE

The hooked bill of the hawk is used to tear away prey.

The chisel-tipped bill of the woodpecker is used to dig insects out of the wood.

The strainerlike bill of the duck is used to seive food from the water.

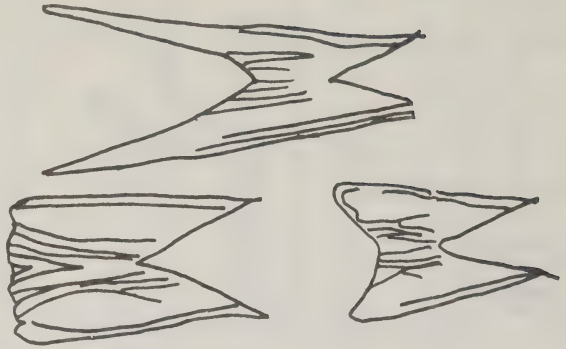


The stout, heavy bill of the seed crackers.

The spearlike bill of the heron is used to catch fish and frogs.

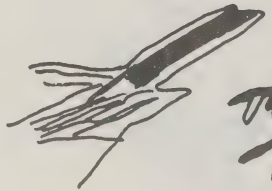
What kind of bill does the bird that you are observing have?

D TAIL SHAPE AND MARKINGS



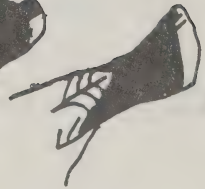
Is the tail forked, squared or rounded? If not use other words to describe the tail.

Does the tail have



outer white tail feathers,

white tail tips,

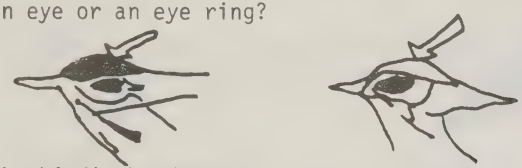


tail band or

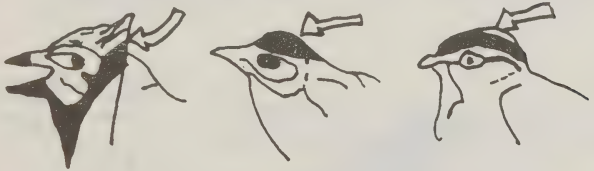
colored rump patch?

E SPECIAL MARKINGS

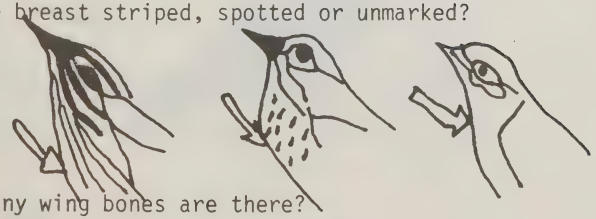
Special Markings. Characteristic markings help in observing birds. These are known as "field marks". Does the bird have an eye or an eye ring?



Does the bird's head have a crest, crown patch or crown stripes?

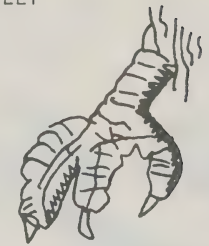


Is the breast striped, spotted or unmarked?



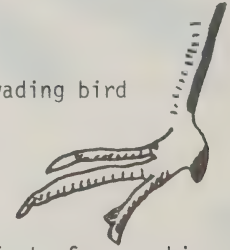
How many wing bones are there?

F FEET



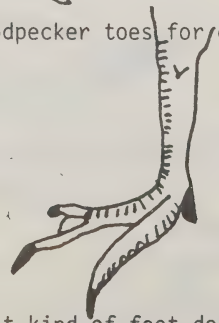
Curved claws of birds of prey.

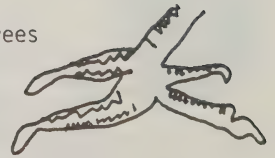
Long legs of a wading bird



Feet of a perching bird

Woodpecker toes for climbing trees





Webbed foot of a duck

What kind of feet does the bird that you are observing have

ADAPTATIONS

For the Blind:

Although highly successful with all types of children, the battle of the beaks game was specifically designed for blind children.

One of the most highly-thought of birders in the State of Connecticut is an elderly blind woman. She is able to accurately identify all of the birds in her area by their calls.

All field trips should be preceded by some time spent listening to tapes or records of common bird calls.*

For the Physically Handicapped:

Build birdhouses, baths and feeders in areas where they can be easily seen from windows. Encourage year-round observations.

For the Mentally Handicapped:

The best method of beginning a session on birds is to use stuffed displays with hands-on capabilities. Museums sometimes lend mounted specimens. Local organizations, such as the Junior Field Naturalists Society, can be of great assistance in undertaking a bird study. Films can also be obtained -- sometimes through the local library - which include bird calls as well.

*Note: Identification guides and recordings of bird calls may be purchased through the Nature Canada Bookstore. See "Environmental Materials" Section.

Insects

OBSERVING INSECTS

Insects with their small, delicate sizes, bright colors, and fascinating habits make interesting study projects. They can be found anywhere as they are the most numerous creatures on earth. Over 900,000 species have been identified but some scientists say that this may be only 10 per cent of the insects yet discovered.

This section aims to introduce these living creatures. It does not encourage collecting of any kind or killing for permanent collections. Any insects that are collected should be returned unharmed to the location where they were found.

Although we have included some diagrams at the end of this section, a good identification book such as the "Golden Nature Guide" on insects is almost a must to help identify and classify the specimens found. However, even if a specimen is identified only to the extent of belonging to a certain insect group, such as a grasshopper, termite, fly, beetle, bee, wasp, ant, aphid, mayfly, or as an insect relative such as a spider, centipede or millipede, this is sufficient. Avoid instensive indentification studies which may become tedious.

Initially, young people should be introduced to the various types of insects in their area, their homes and how to catch and observe them. This may generate inquisitiveness and inspire them to undertake further investigations.

BACKGROUND INFORMATION

Description:

An insect, like a sea animal, wears its skeleton on the outside of

its body. This is called the exoskeleton.

The body itself is divided into three: the head, thorax and abdomen. The thorax has three segments, each with a pair of jointed legs attached; so an insect normally has six legs. Most insects have two pairs of wings attached to the thorax; some have only one pair and a few others have none at all. Insects usually have two sets of jaws and two kinds of eyes - simple and compound - and one pair of antennae.

The above is a fairly accurate description of a typical adult insect. There are however some insects whose thorax and abdomen may appear to run together. In addition, many insects in their immature forms (larvae) are worm-like. Immature insects are often difficult to identify.

Insect Relatives:

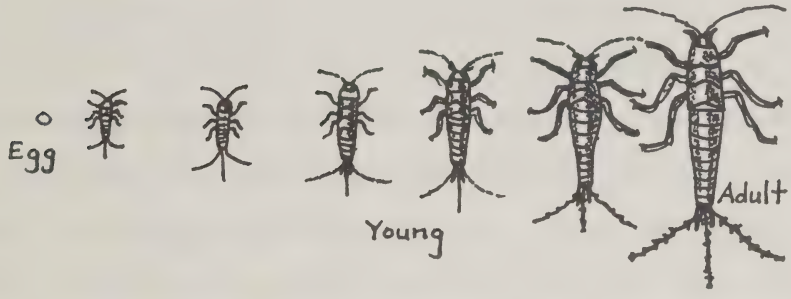
There are numerous insect-like animals which are often confused with insects - spiders, for example. However, spiders have only two body divisions, four pairs of legs and no antennae. Centipedes and millipedes are other examples of insect relatives. Centipedes have a pair of long antennae and millipedes have a short pair but both have many segments to their bodies with one pair of legs (centipedes) or two pairs (millipedes) on each.

Insect Reproduction:

Almost all insects start their lives as tiny eggs laid on leaves, tree branches, on living animals, in flowers, plant stems, fruits

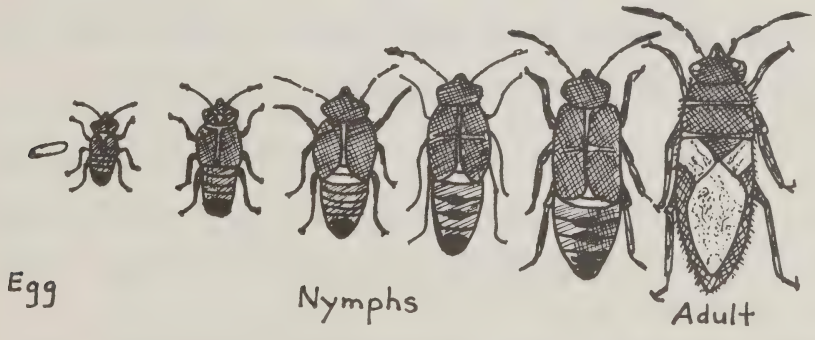
and roots, in rotting carcasses, in the ground or in water. They do, however, become adults in different ways.

In the simplest, the newly hatched insect is like a miniature adult. It grows, and molts (sheds its skin) until it reaches adult size.

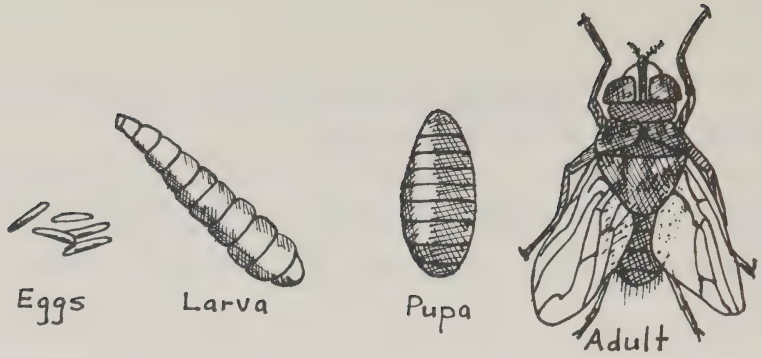


Other insects undergo a process called incomplete metamorphosis.

An immature nymph hatches from an egg, grows, develops wings and by stages becomes an adult.



A third type of reproduction is called complete metamorphosis. This involves four distinct phases: egg, larva, pupa or resting stage and adult.



Seeing, Hearing and Feeling:

An adult insect has two compound eyes - one on each side of its head. These compound eyes are made up of many tiny eyes set close together, like a honeycomb. The six-sided areas into which each compound eye is divided are known as facets. The compound eyes of ants and other insects that live on the ground have only a few facets, and their vision is not as sharp. The eyes of dragonflies and some other species may have thousands of facets.

Many species have also three simple eyes situated between the compound eyes. You will need a magnifying glass to find them.

Insects can perceive mass, motion, light, and color to a certain extent. Bees, for instance, see little of what we perceive but they can see beyond our spectrum and many plant colors are visible to them but invisible to us.

Hearing equipment is located in different parts of the body, according to the species. The grasshopper has an oval membrane sensitive to sound on the side of the first abdominal segment; crickets and ants have hearing organs in their front legs, and the male mosquito hears through its antennae.

Antennae are used to investigate surroundings and in many species are related in some degree to the sense of smell. They are attached to the head in front of or between the eyes. They vary in shape and degree of complexity according to the species.

Insects in Winter:
Insect studies may be carried out in any season. In summer, of course, the insects are more active but the winter is an ideal time to study insects with a powerful venom in comparative safety as they are quite sluggish when cold.

Insects are cold-blooded. This means that their bodies are not internally regulated to a constant temperature so that gradually they take on the temperature of their surroundings. To survive thermal changes, insects have adapted so that during cold periods they enter a resting phase, in which they cease their life activities and development. This stage is called diapause.

A bright, sunny winter day may temporarily revive dormant insects. Check the south-facing sides of rock and stone buildings.

Many adult insects hibernate under logs and rocks, in weed clumps, grass turfs, crevices, and among fallen litter.

Flies: When winter comes flies die but they leave their offspring - in larvae, pupae and egg stages in piles of decaying plants and manure. In the spring new batches of adult flies appear.

Ants: Ants hibernate in their underground tunnels.

Cicadas: Before female cicadas die they bore holes in the twigs of trees and lay their eggs. In about six weeks, the young hatch drop to the ground, dig in and attach themselves to the tree's roots. Some species of cicada nymphs stay in the ground as long as seventeen years. Others for just two to five years.

Butterflies: Some butterflies hibernate; others die after laying their eggs; and, still others such as the Monarchs migrate.

Mosquitoes: Some of the female adults winter in logs, caves or houses. The eggs wait out the winter.

Crickets: Each female lays as many as 300 tiny, banana shaped eggs in the ground before she, like the male, dies.

Grasshoppers: The female digs a hole in the soil and lays anywhere from 2 to 120 eggs and covers them with a special waterproof juice. All grasshopper adults die.

Wasps and Bumblebees: Only the young queen wasps and bees stay. They sleep underground until spring.

Honeybees: When the temperature falls below 13°C/55°F the bees form a thick ball in their hive and feed on the stored honey. They keep moving slowly about in their ball so that those in the warm centre move outward and those in the colder outer sections move inward.

Ladybugs: Ladybugs or ladybird beetles hibernate in haystacks, forest logs, under leaves, among rocks or under loose sidings of buildings. Sometimes on warm days, ladybugs wake up, make a

flight and then return to sleep.

See also "Insect Sightings in Winter" at end of this section and Small-Flying Animal Descriptions at end of Lawn Section.

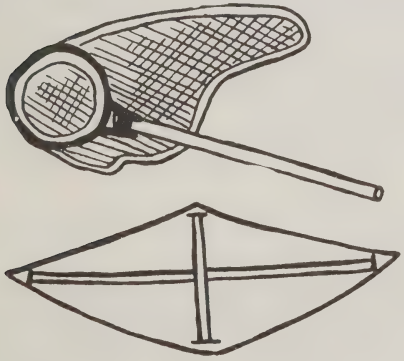
ACTIVITY I

1. In-ground traps:

- cans, soft drink or soup cans with top removed may be used
- sugar, honey, jam or similar sweet bait
- rotting meat or piece of fruit or similar solid bait

Sink a tin can or similar container into the ground placing either the sweet or solid bait inside. Cover the can with a rock or a piece of wood allowing some air space to protect any captured specimen from the rain. Crawling insects such as beetles will be lured into the can.

2. Sweeping nets and beating cloths:



- coat hangers
- fabric, old sheets, tea towels, or any cotton material
- netting
- wooden handle, broken hockey stick, broom handle (optional).
- umbrella (optional).
- wood, sticks are fine

To make the collecting nets bend the coat hanger wire into a circular shape. Sew the cotton into a bag about .6m (2 feet) long and .45m (1½ feet) wide and then sew it onto the wire frame. Do

the same with the netting material. Attach the handle to the frame and bag with tape or wire. You may extend the wire from the frame and make it into a loop instead for use as a handle.

The cotton net is used to sweep through long grass and weeds to pick up the insects hiding there. The catch may be emptied into the specimen container to be observed and identified. The net made from mesh is used for collecting insects flying in the air such as butterflies and moths.

The beating cloth is used to catch insects as they fall out of trees and bushes which are gently knocked or shaken. An old sheet may be held under the tree by several campers while another shakes the branches. A beating cloth may be made by attaching pieces of wood, sticks, or hanger wires to a piece of cotton that is about 1m or roughly 3 feet square in size. (see above diagram.)

3. Insect container:

- container, a 2.28 litre (½ gallon) milk carton with the top cut off is ideal.
- mesh, wire screen
- string, roughly 1m or roughly 3 feet in length

Attach the string to the container to form a carrying handle. The screen can be held over the top with elastic bands. Glass jars may also be used but are not recommended because of the possibility of breakage.

4. Field notebook: - paper attached to a board or heavy cardboard with a pencil attached

5. Magnifying lenses: (optional)

PROCEDURES GUIDELINES

A suitable location for an insect study is an open field of long grass and shrubs with a nearby woodlot. Begin this hour-long activity by demonstrating how to set up the in-ground traps, how to sweep the net back and forth through long grass, weeds and shrubbery and how to hold the beating cloth under the trees and how to gently knock, shake, and beat the branches.

Groups of two or three youngsters working together can then use these techniques to collect insects. The insects are then placed in the specimen container, observed, identified, and recorded in the field notebooks. If the young people cannot identify something they

have caught, a carefully drawn picture is advantageous. The in-ground traps are checked at the end of the session.

The group leader should rotate between the participants to help them identify specimens, to offer advice on collecting techniques, and to encourage careful observations through the use of questions as outlined below.

If time permits, centipedes, millipedes, sowbugs, pillbugs, and some beetles may be discovered by looking in damp, dark places such as under large rocks, old boards and pieces of wood, and under leaves. An ant colony may be studied by watching the ants' behaviour when bread or cookie crumbs are sprinkled nearby. Spiders may be found in shrubs, in the cracks of tree trunks, in the ground, or in dark places. How many different kinds of spider webs can be found? A spider may be hiding near its' web under a leaf or branch so look carefully. In a woodlot the children can examine a 30 cm or one foot square of ground under the trees, quietly searching for the tiny insects that make their homes there.

Look for insect signs such as damaged or diseased plants, sticky substances on plants and insect homes such as galls, cocoons, mud nests, winding tunnels in rotting wood, in the ground, and also on leaves.

As often happens in outdoor activities, youngsters are full of energy, boisterous, and noisy. Stress quietness. The sound of our voices is as loud as thunder booming in the sky during a rainstorm to nearby insects. Let's not scare them away.

QUESTION GUIDELINE

Flies: How many wings do you see? What color are they? How many legs does it have? Can you see its' eyes? What color are they? What kind of noise is it making? Can you see its' mouth?

Ladybird Beetles: Can it fly? How many spots does it have? Does it have the same number of spots as another one? How long are its' legs? Where did you find it? What kind of plant was it on?

Butterflies: Are its' wings smooth and shiny or fuzzy and rough? Where are its' legs? How long is its' body? How wide are the wings?

Leafhoppers: Are all its' legs the same length? Why is this? How many different colors can you see on its' body? What shape is its' head? How far can it jump?

Carpenter Ants: How does it hold food and move at the same time? How many parts or divisions is the body composed of? Does it have feet? How long are the antennae? Does it have wings? Why not?

ADDITIONAL ACTIVITIES

1. Follow a crawling insect along the ground. What does it eat? Where is its' home? How fast did it move?

2. Have a grasshopper race. Be careful when holding the insect in your hands. It does not enjoy being squeezed too hard.

3. Build a maze and put an ant in it. How long did it take to find the food? Try it several times. Did it take less time the second or third time?

4. Make an insect out of popsicle sticks. How is it adapted to its environment? (Wings? Mouth parts? Coloring?)

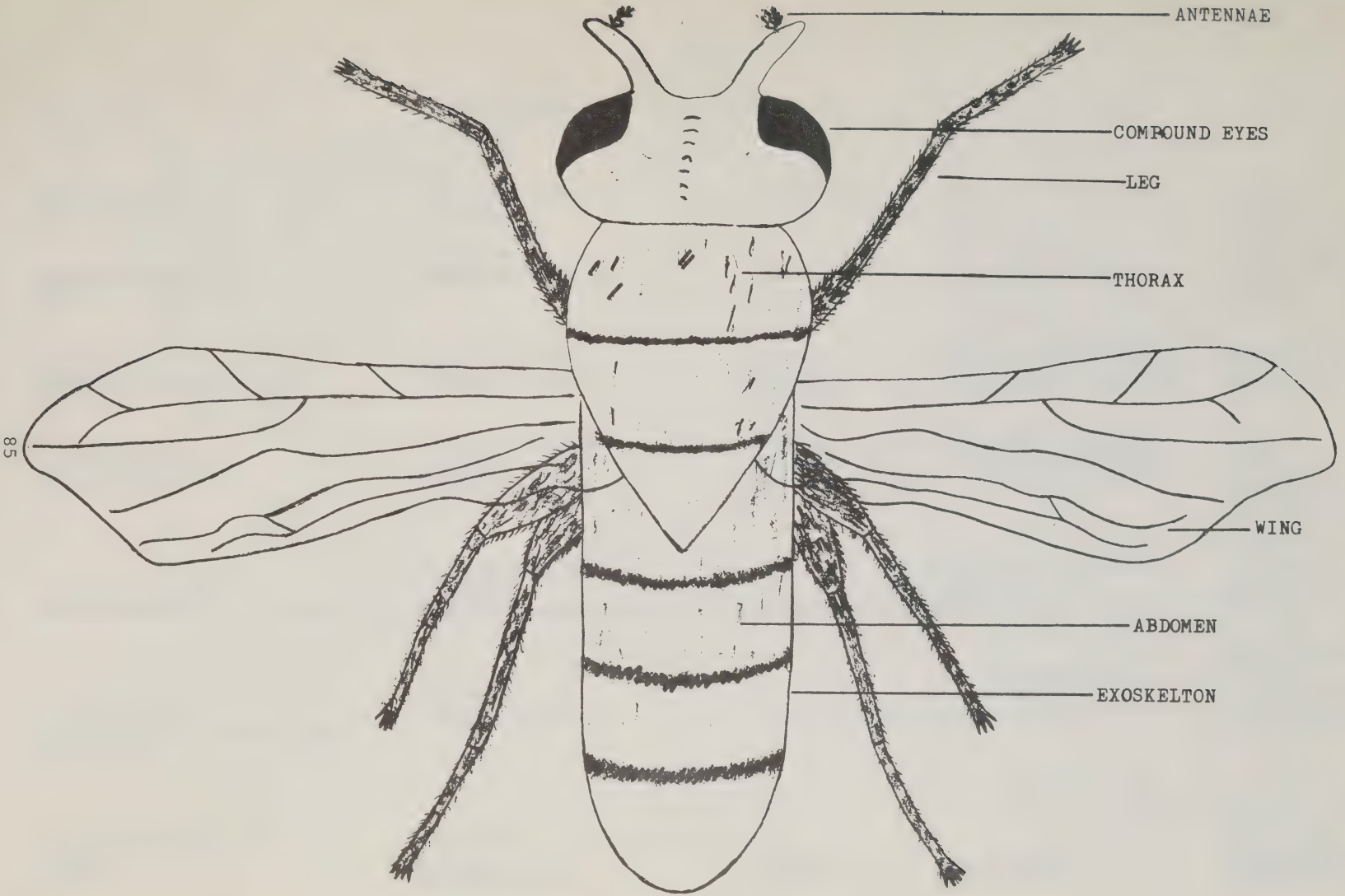
5. Look for insect homes on galls, plants, trees on the ground etc.

6. Discuss the ways in which insects are beneficial or harmful. Thought should be given to their importance in pollination; in producing food, such as honey; in controlling other insects (dragonflies eat mosquitoes) and weeds; and in providing food for other insects and birds. Equal thought should be given to their crop-destroying, disease spreading and nuisance characteristics.

7. A brightly colored light in the dark will attract great attention. Have you ever seen the insects which fly around certain lights.

   Using extension cords, leave a lamp turned on outside with a clear light bulb shining. Place behind or under the lamp a white sheet. After an hour, take a look at the creatures that have landed on the sheet. What have you attracted with your lamp? Try using light bulbs of different colors, such as blue, yellow, or red. Which lights are attractive to insects? Which are not?

8. We "talk" with light all the time. How about neon signs, for instance? But we are not the only ones who "talk" with light. At dusk, go to a large grassy area and watch carefully. As the natural light grows dimmer, you may begin to see many flashes of color that look like small jewels. These flashes are made by fireflies (lightning bugs). The flashing colors are the way male fireflies "talk" to the females of their kind. There are many kinds of fireflies. Each uses a special code of light flashes. Try to discover these codes by observing the number and the timing (how often) of the flashes. Using a small pencil flashlight, try to "talk" to the fireflies in their own code. If you are successful, they will flash back at you.


ANTENNAE
COMPOUND EYES
LEG
THORAX
WING
ABDOMEN
EXOSKELTON

TEN COMMON INSECT ORDERS

Orders	Metamorphosis	Mouth	Field Marks	Examples
Orthoptera "straight-winged"	gradual 3 stages	chewing	FW leathery	grasshoppers crickets cockroaches mantids
Hemiptera "half-winged" 2 sub-orders				
a) Heteroptera "varied-winged"	gradual change 3 stages	pierce-sucking	FW leathery at base thinner at extremities	stink squa squash bugs boatman backswimmers
b) Homoptera "wings-alike"	gradual change 3 stages	pierce sucking	wings clear or leathery FW form roof over HW	cicadas aphids, leaf and tree hoppers spittlebugs
Ephemeroptera "Ephemera-winged"	gradual change 3 stages	non-functioning in adult	wings delicate many cross veins nymphs aquatic	mayflies
Odonata "toothed" (moth parts)	gradual change 3 stages	chewing	long slender insects with long clear wings. Nymphs aquatic	damaelfly dragonfly
Neu "nerve-winged"	complete change 4 stages	chewing	wings equal in size with many fine veins.	Ant-lions Lace-wing flies

Trichoptera "hairy-winged"	complete change 4 stages	sucking larva-chewing	wings covered with long hairs; larvae aquatic often in cases	caddisflies
Lepidoptera "scaly-winged"	complete change 4 stages	siphon-sucking larva-chewing	wings covered with scales	moths skippers butterflies
Coleoptera "sheath-winged	complete change	chewing	FW horny, meeting in straight line down back over HW	potato & lady beetles fireflies
Hymenoptera "membrane-winged"	complete change 4 stages	chewing lapping sucking	FW larger, HW often hooked to FW or no wings	wasps ants bees
Diptera "two-winged"	complete change 4 stages	pierce sucking or sucking	one pair of thin transparent wings	gnats flies mosquitoes craneflies

FW - Front Wings HW - Hind Wings

From Massachusetts Audubon Society - Lincoln, Mass. 01773. Curious Naturalist Supplement No. 13A

Insect Sightings in Winter

Springtail (Achorutes nivicolus)

Springtails or "snow fleas" can be found at the base of a tree on warm winter days or where the sun has melted through to a patch of leaves. They are very small and at first may appear to be soot. They generally inhabit the surface of the soil, but may also live on the surface of ponds and in tidal zones. Their common name, springtail, refers to the two appendages they have on their last body segment. These are like two modified legs which are normally folded against their abdomen and held in place by two clasps. When the clasps open, these two appendages spring against the ground, propelling the insect a few inches away. This movement has resulted in their misleading nickname, snow flea.

Stonefly (order Plecoptera)

Stonefly larvae, which live in streams, start feeding and growing in fall and early winter. The adults emerge from the water in midwinter and mate on the shores; then the females lay their eggs back in the water. They are often found crawling over rocks and snow at stream edges, where as adults, they come to feed on algae. Stoneflies can live in only clean rushing water, the larvae living and feeding under stones at the river's edge. When they fly they appear like large gray mosquitoes.

Paper Wasp (Polistes fuscatus)

Male and femal wasps mate in the fall, and both go into hibernation in rock crevices and rotting logs. Only the queen lives through the winter, emerging in the spring to seek out a good nesting site. She then builds a few cells and lays an egg in each one. At this point, other queens which did not complete their own nests, join our queen and become her workers, finishing cells that she initiates and feeding the larvae when they hatch from the eggs. After the larvae are full-grown white grubs, they seal off their cells and pupate, emerging later as female workers.

At the end of summer, the queen lays more eggs which are fed extra amounts of food and develop into idle males and queens. These types hang around the nest and are fed by the workers. In the fall the males and new queens leave the nest, mate, and hibernate. Only the queens with extra reserves of fat stored in their bodies live through the winter to resume the cycle in the spring.

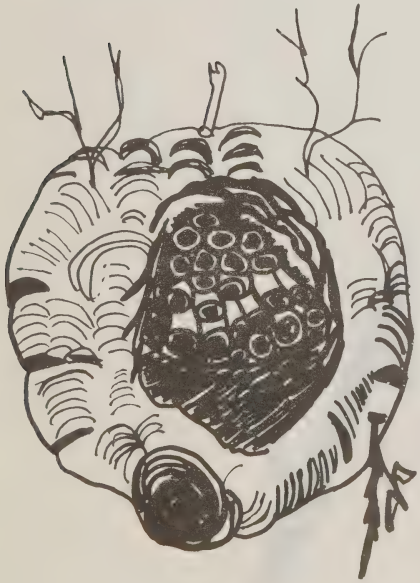
The nests themselves, are often found on the ground in the winter, blown there by the wind. Other good spots for seeing them are in abandoned sheds, garages, barns, and under the eves of wooden buildings.

They are made with dried wood and plant fibers, which are gathered from fenceposts, old buildings, and dead trees. The wasps take the wood bits to the nest, chew them, mix them with saliva, and apply them as paper pulp in circular motions to each cell. Variations in color of the cells, reflect the different sources of wood.

The nests are hung with the cell openings facing downward and are attached usually by a single thread-like *pedicel* (stalk). The top of the cells are usually coated with a shiny substance that makes the paper water-resistent.

Hornets, Yellow Jackets (Vespula species)

The life cycle of hornets and yellow jackets is the same as that of the paper wasp except that the queen is never joined by other queens.



The nests are abandoned in winter and can be safely collected and inspected after below-freezing weather has set in. They are built at any level, in trees, shrubs, or sometimes under the eves of house roofs. They vary in size from 20 to 45 cm in depth (those of Yellow Jackets often being the smaller ones).

The nests of these insects are more advanced than those of the paper wasps. After the first workers hatch, they build new cells and enlarge the nest by chewing away the inner layers of the envelope and adding new layers to the outside. Paper is made by collecting strips of dried wood, chewing them, and adding a fluid that acts like glue to hold the paper together. The paper is added on in arcs that curve away from the hive. This makes the layers quilted and holds them apart so that their insulating effect is maximized. Most nests have between six and eight layers of paper, the total covering averaging 5 cm in thickness.

If you cut open part of a nest, you will find that some of the cells may be short, which means they were never finished; some cells may contain dry larvae, which means the nest was abandoned before they matured; other cells have an added white layer of paper. These cells were going to be used a second time.

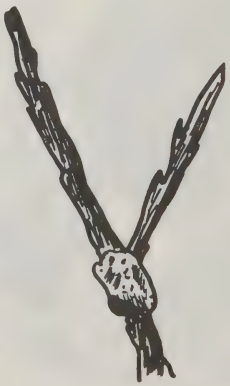
The entrance to the hive is a hole placed in one side at the base. Although the wasps abandon the nest in the winter, many other types of insects and spiders spend the winter within it.

These nests are also built underground in a mammal burrow or natural cavity. They are often found in the fall, torn open by skunks or racoons, who were seeking the grubs when the insects were slowed by the cold.

Eastern Tent Caterpillar
(Malacosoma americana)

The nests of the Eastern Tent Caterpillar are not particularly attractive in winter, when they appear as ragged masses of webbing filled with dried leaves and crumbling excrement, but they are a common sight once the leaves have gone from the trees.

In spring, when the eggs first hatch, the caterpillars crawl down the branch to the first large joining of two branches. Here they build a web for protection against such predators as birds and other insects. To feed, they leave the nest and crawl up the branches to the leaves.



The webbed nest is made communally and soon becomes filled with the remains of the caterpillar feces, as well as molted skins, for the larva, like insects in all stages of growth, must shed its skin as it grows. The caterpillars continue to add on layers of webbing, so that the final nest is made up of many layers filled with excrement and molted skins. This stage lasts six weeks. At this point, after a certain number of molts, they drop from the nest and spin cocoons in sheltered areas.

In three weeks they emerge as adult molts, then they mate and the females lay their egg masses on host twigs. These egg masses can also be found in winter. They contain 100 to 300 eggs and are surrounded with a shiny, waterproof, foamy material. An excellent place to spot egg cases is a group of Black Cherry or Chokecherry trees.

Old nest of tent caterpillar

ADAPTATIONS

For the Mentally Handicapped:

A see-item-live-creature-hunt is usually successful. Insects must be caught, sighted by a judge and released alive.

Note: care must be taken that the youngster does not accidentally kill the insect as it could be very upsetting.

Try this game!

1. Each youngster is given a picture of an insect with numbered parts.
    1. Antennae
    2. Compound Eye
    3. Head
    4. Thorax
    5. Abdomen
    6. Leg
2. Each youngster takes a turn throwing a die.
3. The youngster then colors in whatever section the number on the die indicates.
4. If he throws a number for an already colored-in section, he passes the die on to his neighbour.
5. The first person to color in the whole insect is the winner.

For the Blind:

See games and suggestions in Lawn Section.

Lawns

A LAWN STUDY

While sitting outside on a hot summer's day, did you ever stop to wonder about what was going on in that miniature world at your feet? Is there a war underway? A food hunting expedition? Has a new species of plant decided to take over?

There are a lot of things to examine when you get down on your knees and practice a bit of "belly botany".

BACKGROUND INFORMATION

The physical setting, the climate animal life, vegetation and soil all affect each other and influence the types of organisms (living things) that can exist at that site.

Physical Setting: In an open area, the organisms present must be able to withstand harsh conditions, such as wind, extremes in temperature, lighting (day and night differences) and periods of flood and drought.

On the other hand, organisms dwelling in a forested area are more protected from these problems.

Soil is another physical factor which determines the types of animals and plants found at a site. For example, only the organisms which are tolerant of an acidic soil can live in a coniferous forest. (Pine needles decompose to form a very acidic soil.)

Vegetation: Plants which depend on insects for pollination are usually colorful and have a sweet-smelling nectar to attract the insects. Wind-pollinated plants have no need for color or odour. However, they adapt in other ways. Grass, for example, has long, protruding stamens bearing an abundant load of pollen to facilitate wind pollination. In addition, the fine, flexible structure of grass allows it to bend easily and rub against adjacent plants to transfer the pollen. (For a diagram of a flower and a description of its parts, see last page of this section. See also wildflower description in the Nature Hike Section).

Animal life: An insect's structure is often adapted to its habitat. Organisms, such as the earthworm, which live in moist soil, often have a moist skin, whereas organisms found in a drier habitat have a thick, hard outer shell, beetles for example, to prevent them from drying out.

Often the insect species has a coloring which helps it to blend with its habitat.

ACTIVITY I

To build a quadrant for a lawn study. (A hula hoop or long rope tied in a circle could be used instead of the quadrant approach.

Equipment: tent pegs, wooden stakes or popsicle sticks
measuring stick or tape
string

1. Using the tape, measure out 1 metre or 3 feet on the ground.
2. Push a stake into the ground at either end of the tape.
3. Place one end of the tape at a ninety degree angle from one of the pegs. Measure out another metre and insert a peg.

4. Repeat. You should now have a square.

5. Tie string between all pegs.

THINGS TO LOOK FOR

1. Physical Characteristics:

(a) Is the soil wet, moist, or dry? What color is it?
(b) Record the temperature on the ground and about four feet above the ground. Compare the temperatures. Do you think that temperature plays a role in the survival of life in the quadrant.
(c) What type of terrain is the quadrant in? Is it open and flat or is it steep and rolling?
(d) Is it sunny and hot or shady and cool?
(e) Is it windy or is it calm? What direction is the wind blowing?
(f) How does a site affect the vegetation? The animal life?

II. Vegetation:

(a) Is the width of all grass blades and their heights the same throughout the plot? Is there more than one species of grass?
(b) Can you find different colors of vegetation?
(c) If seeds are present, how did they get there and where did they come from?
(d) Are the plants in the quadrant low growing or creeping, or are they bushy and tall?
(e) Can you find any dead or decaying vegetation? Why is it important?
(f) If dandelions are present, are they in flower or have they all gone to seed?
(g) Can you find any clover with more than three leaflets?
(h) Is moss found in dry or moist places? What does it feel like?
(i) Are there any wildflowers in your quadrant? Do they have a strong or weak scent? Why is this important?
(j) By looking at the down in the flower heads of thistles and the spines on the leaves, how do these features adapt it for survival?
(k) How does the vegetation affect the animal life?

III. Animal Life:

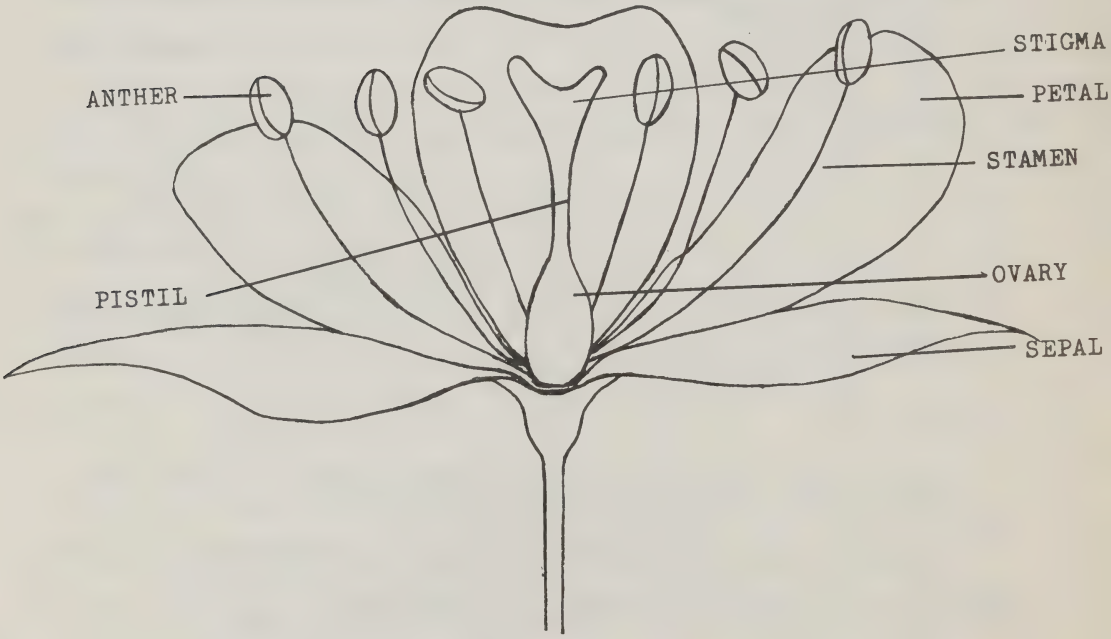
(a) Do you see any insects such as bees, wasps, or flies hovering over a particular type of vegetation?
(b) What kinds of sounds can you hear?
(c) Are there any insects such as aphids, grasshoppers, or leafhoppers on the plants? (See section on Insects.)
(d) Are they moving? How fast do they creep?
(e) Can you find the same insects in both short grass in and in long grass?

(f) Have the young people get down on their hands and knees and carefully part plants so that they can see the ground surface. Spiders, beetles, land snails, slugs, larvae, mites may be found. How are these animals suited to their environment?
(g) Can you find any evidence of animal life such as worm castings, worm holes, ant hills, or spider webs?
(h) How does the animal life affect the vegetation?

Additional Activities

This activity can be repeated in different areas: Under a tree, beside a driveway, in a forest, a field, etc. It can also be done in the same setting from spring to fall. You should see a variety of changes as the seasons alter.

PARTS OF A PERFECT FLOWER



A pistil is the workshop of the flower. At the bottom of each pistil is an ovary, in which tiny seeds, called ovules, are formed. (Some ovaries contain only one ovule.) Each ovule contains an egg cell.

When a pollen grain is transferred by insects, birds, the wind, etc. from the male part of a flower -- the stamen -- to the female organ -- the stigma -- (this is called pollination) the pollen grain forms a tube that grows downward to touch the egg cell in the ovule. The ovule begins to grow and develops into a seed. The seeds stay in the ovary until they are ripened and ready to be scattered by the wind, animals, water, man, or by expulsion.

Some flowers have both a pollen-bearing stigma and a pistil with an ovary. These are called perfect flowers. Others may have only the stamen (male flowers) or only the pistil (female flowers).

The corolla is composed of the petals. In many flowers, it is made up of separate petals. In some, as in the petunia and morning glory, the corolla is completely in one piece.

The sepals encircle the petals and protect the flowers. All the sepals together make up the calyx. Sepals are really specialized leaves, varying in different kinds of flowers in size, shape and humbers. Often they are green, as in roses, or they may be the same color as the flower, as in tulips, for example.

GAMES

Inventing your own animal

Equipment: cotton, balloons, string, tin-foil, various perfumes, glue, pipe cleaners and potatoes.

Activity: Have the children design an animal using the potato as the body and pipe cleaners for the legs. The idea is to design it in such a way that it is protected from predators and yet its mate can still find it.

Use this activity to convey the concept of animal communication and protection. For example, how does a skunk protect itself. How does a moth find a flower at night?

Inventing a plant

Goal: To construct a model of a plant which is adapted to a particular environment.

Equipment: hobby wire, paper, glue, cotton balls and tape

Activity: Bend the wire into the form of a flower that is designed to fit a specific habitat. Flowers can be made by gluing cotton balls or disks of paper to the wire. Children must think out the hazards of an environment and design a plant to live there. For example, a lawn plant has to survive and lawn mower and a desert plant has to conserve water. Once the environment is chosen, the child invents a plant from the grab bag of supplies.

Have the child describe the plant and defend the reasons for designing it in a particular way.

Seed dispersal

Goal: To invent ways of dispersing seeds.

Equipment: cotton balls, balloons, tape, pinto beans, tongue depressors, paper clips and glue

Activity: From the supplies, have the children invent some seeds that would be capable of getting from point A to point B. For example, sticky tape wrapped around a bean- sticky side out- could represent a seed such as a cocklebur, which travels by hitchhiking.

Broadleaf Plantain

Large, smooth, roundish leaves, 3 to 6 inches long. Flower stalks 3 to 6 inches long are easily seen sticking up from the plant's centre. Perennial.

Narrowleaf Plantain/Buckhorn

Long, narrow leaves with parallel veins, 3 to 12 inches in length. Long flower stalks stick up above leaves. Perennial.

Thistle

Almost stemless, with leaves notched with long spines that hurt if touched at edges. Leaves are spiny and have short hairs and "pimples". Flowers, when present, are purplish. Perennial.

Curly Dock

Almost stemless, with large, reddish-green leaves that are curly and wavy along the edges, growing in a circle around the base of the plant. Flower stalks appear in the centre of the plant and are green or reddish-brown in color. Perennial.

Spurge

Very low growing; stems form circular mats from single root. Stems and leaves are green or often reddish. Positive identification -- pinched leaves yield a milky sap (poisonous). Annual.

English Daisy

Low growing with oval leaves. Flowers stick up. Easy-to-see white or pinkish daisy-like flowers. Perennial.

Clover

Common, non-grassy lawn plant. Three-lobed leaf. Low growing, roots at joints. Flowers white, red, or pink. Perennial.

Burclover

Related to clover. Clover-like leaf. Stems are low growing and spreading. Flowers are small and yellow. Seed pod or "bur" is spiraled and spiny. Annual.

Non-Grass Plants

Chickweed

Slender, much-branched stems with a line of white hairs along one side. Leaves smooth and pointed. Likes it cool. Annual.

Scarlet Pimpernel

Low growing. Stems branched. Most identifiable feature: under a clear sky salmon-colored small flowers are easily seen. Annual.

Dandelion

Almost stemless, with jagged leaves growing in a circle around the base of the plant. Flower stalks rise from the base. Easy-to-see yellow flowers turning into familiar puff-ball seed head. Annual, biennial, or perennial.

Sedge

Very narrow and stiff-leaved plant. Without its flower it looks very grass-like. Unmistakable flower stalk: Little clusters of green flowers growing at the base of six spike-like leaves. Triangular stem, usually taller than lawn. Grows in very wet areas.

Kentucky Bluegrass

Very common and desirable lawn grass. Can be identified in cut stage by looking with a hand lens at veins on upper side of leaf -- look like railroad tracks running down the middle. Will flower along uncut edges of lawn; very tall, from 1 to 2 feet high. Perennial.

Annual Bluegrass

Short, soft, light-green grass. Will continue to form flowers and seeds even under frequent mowing. Usually found in cool, frequently watered areas. Look for light-colored flowers growing on short grass plants in lawn. Annual.

Foxtail/Wild Barley

Occurs as clumps, often in new or infrequently mowed lawns. The leaves are smooth, dull green. The mature seed heads look like a squirrel or fox tail. Often sticking in socks or shoes.

FUNGI

Mushrooms

Many kinds of fungi appear on lawns. Most are in the familiar toadstool shape. Others are button-like. They are usually white or light brown, but can range from bright red, blue, yellow to black. Many are poisonous. Mushrooms do not manufacture their own food, but live off decaying plant material.

Moss

Small, short, soft stemmed plants. Many plants to a patch. No flowers. Found in over-watered lawns. Annual.

Oxtails/Sourgrass

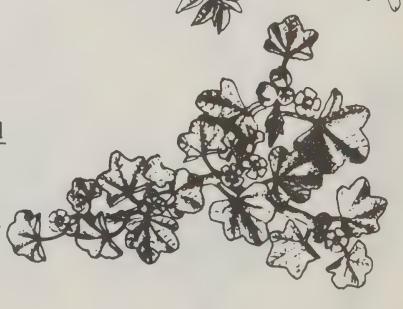
Looks like clover, but not related. Prefers shade. Grows low with runners. Flowers yellow, small. Stems taste sour. Perennial.

Knotweed/Knotgrass

Very low growing; forms circular mat. Found in areas with lots of foot traffic. Slender, wiry, non-rooting stems. Leaves bluish-green and smooth. Very small white flowers.

Mallow/Cheese Weed

Stems low and spreading. Leaves roundish and broad. Fruit looks like little rounds of cheese. Annual or often a biennial.



Grass Plants

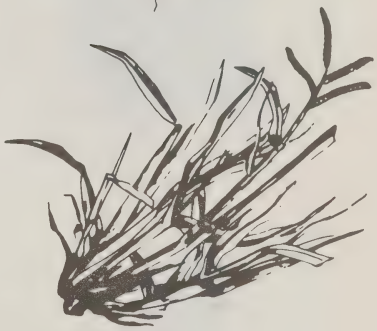
Since grasses are easy to identify when they are in flower, and only weedy grasses usually flower in a regularly mowed lawn, most of the grasses listed are weedy species. Flowers are usually green, brown, or beige.

Crabgrass

Fat leaves, yellowish-green in color, often hairy. Best way to tell is to look at flower. Spreads by seed and runners. Annual.

Bermuda Grass

Thick, coarse grass. Stems are smooth and wiry. Runners have many jointed parts with roots at each joint. Flower somewhat similar to crabgrass. Perennial.



Goosegrass

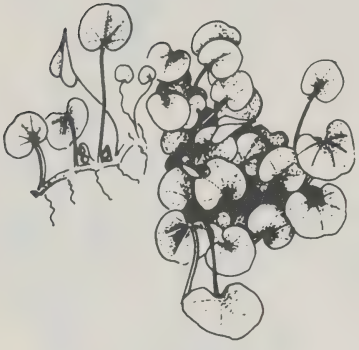
Low, thick mat-forming grass, growing from central point. Appears as a silvery, pale green clump. Will flower even under constant mowing. Distinctive flower. Annual or short-lived perennial.

Ryegrass

Long, narrow leaf, hard to tell from regular lawn grass unless flowering; somewhat glossier than most grasses. Forms clumps. Annual or short-lived perennial.

Bristly Oxtongue

Tallish. Coarse, rough-looking plant. Leaves covered with rough hairs and pimples. Flowers are yellow and look somewhat like small dandelion flowers. Biennial.



Dichondra

Low, creeping stems, root frequently at nodes. Can form dense mats, or even "lawns". Leaves lily-pad shaped; 1/4 to 1-1/2 inches in width. Flowers rarely seen. Perennial.

Cutleaf Geranium

Low growing, many branches per plant. Leaves are divided into narrow fingers. Easily seen small purple flowers. Annual.

Small Flying Animals

Dragonflies

Brightly-colored, fast-flying insects. Hard to catch. They have four large wings, which are held out when at rest, and a large head. Food: small flying insects.

Damselflies

Look like skinny dragonflies. Wings are held close together and point backwards when at rest. They are usually very brightly colored. Food: small flying insects.

Frit Flies

Small black flies. Usually very numerous. However near lawn surface. Food: larvae feed on grass stems.

Houseflies

Several species of medium-large flies, all of which look something like the common housefly. The location of your lawn will determine the exact species. Stout-bodied, very active; single pair of wings. Food: scavengers on all sorts of decaying vegetable and animal waste matter.

Weevils/Snout Beetles

As their name implies, these are beetle-like in appearance, with the head more or less elongated into a snout. Weevils, like beetles, prefer to run rather than fly. Food: almost all feed on plant material.

Earwigs

Slender, medium-sized insects with large pincers on the end of the abdomen. Earwigs are largely active at night and hide during the day in cracks, crevices, and under objects. Food: mainly scavengers, but also eat live plants.

Grasshoppers

Long-legged, jumping insects. Usually green or brown, they range in size from 1/4 inch to over 3 inches. Very large hind legs to aid in hopping, they also fly. Males sing by rubbing the inside of the hind leg against the lower edge of the front wing. Food: plant feeders.

Leaf Hoppers

Small bugs, very numerous at certain times of year. Oval-shaped body, segments not well separated. Will move sideways, hop, or fly. Often interesting coloration: black, brown and white, or all green, some with red markings. Food: suck plant leaf juices.

Springtails

Tiny wingless insects that are very plentiful. They are named after their unique forked tails that they keep folded beneath their body. When disturbed, the tail springs downward, catapulting the insect into the air. May be dark-colored, yellowish, or colorless. Not likely to be caught with nets, but very likely found in traps. Very numerous in the soil. Hand lens is really needed to see them well. Food: scavengers, some feed on microscopic plants.

Ants

Small, black (sometimes red), narrow-waisted, round-dwelling insects (rarely, winged ones can be found). Often found in large numbers, in swarms or lines. Antennae are usually elbowed. Familiar insect, lives in large colonies. Food: varied; some ants are predators, some herbivores, others scavengers.

Aphids

Small, round, soft-bodied insects. With wings at certain times of year, without wings the rest. Usually green, can be black or brown. With a hand lens, one can see tiny pegs sticking up from rear of abdomen. Food: adults and young suck plant juices.

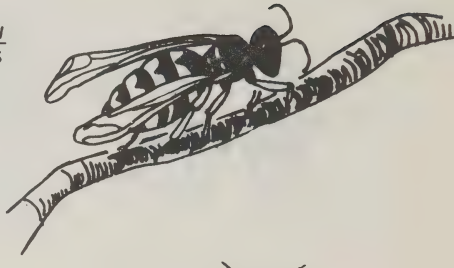
Spiders

Many kinds of spiders can be found on lawns. All have eight legs, two body segments, and piercing mouth parts. Many spin webs to catch their prey; others, like the wolf spider pictured here, don't have webs but pounce on their victims. Food: all are predators.

Bees

Familiar honey bee with hairy, yellow and black striped abdomen. Usually found near or on clover, dandelion flowers, or other showy non-grass plant flowers. Food: pollen and nectar from flowers, nectar converted into honey back at hive.

Yellow Jackets



Very showy insects with bright black and yellow markings on its non-hairy abdomen. These wasps are pesty and will sting if disturbed. Food: scavengers, very noticeable during picnics.

Small Wasps

Any of a number of species of small, black, narrow-waisted wasps. Common in small numbers at all times of the year. Food: most are parasitic, laying their eggs into a host insect; the larvae feed on that host from the inside, eventually killing the host.

Butterflies

Slender-bodied insects with large, often brightly-colored wings. Wings are covered with tiny scales. Antennae are slender with a swollen knob at the end. Food: adults often don't feed -- if they do, usually on flower nectars; larvae feed constantly on plant material.

Pictured here:

Monarch - black and orange
Cabbage - white and black

Typical larvae or caterpillar

Mosquitoes

Skinny, long-legged small flies. Only one pair of wings, which are fringed with tiny scales and hairs (a hand lens is needed to see these). Most have long, piercing, sucking mouth parts. Food: females suck blood, males feed on nectar and plant juices.

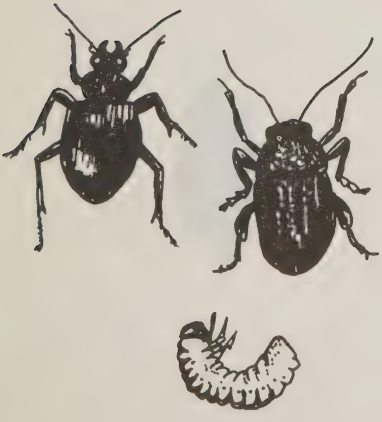
Aphids

Small, round, soft-bodied insects. With wings at certain times of year, without wings the rest of the year. Usually green, can be black or brown. With a hand lens, can see tiny pegs sticking up from rear of abdomen. Food: adults and young suck plant juices.

Small Non-Flying Animals

Ladybug/Ladybird Beetles

Medium-sized, round, reddish-orange beetles with black spots (or reverse coloring). Often very common. Can be seen crawling to top of a blade of grass, flying a short distance, and repeating the action. Food: both adults and larvae are predators; favorite food is aphids.



Beetles

Many types of beetles can be found on lawns; only the ladybird beetle is common enough to be specifically identified here. Beetles range in size from less than 1/8 inch long to 1 inch long. Pictured here are two kinds likely to turn up. A ground beetle and a flea beetle. Beetles are all hard-bodied and rarely fly. Their wings are folded under their hardened backs. Food: some are predators, others are herbivores, still others are scavengers. Ground beetles are mostly predators, flea beetle adults feed on leaves, and the larvae feed on the roots of plants, particularly dichondra. Larvae often eat different food than adults.

Mites

Tiny spider-like animals; all adults have eight legs. Mites look like fast-moving dots. Colors vary; red, orange, brown, and black are most common. Food: varies; some are predators, others herbivores or scavengers.

Millipedes

Medium-sized, elongated, wormlike animals with many legs. Most millipedes have 30 or more pairs of legs, usually two pairs per segment; Often millipedes can be found rolled up into a ball. Food: most are scavengers.

Centipedes

Medium-sized, elongated, flattened, wormlike animals with 15 or more pairs of legs. Each body segment has a single pair of legs. Very active and fast-running, unlike millipedes. Usually orange in color. Some will bite or sting if held in the hand. Food: predators.

Isopods/Pill Bugs/Sow Bugs

Medium-sized, oval-shaped, armored animals. Brown, black, or grey in color with yellow spots. Legs originate underneath the armored back and often can't be seen from the top. When alarmed, pill bugs roll up into a tight ball, or "pill". They live in cracks, crevices, or even out in the middle of the lawn. Mainly active at night. Food: mainly scavengers, but will eat fresh plant material.

Snails

Soft-bodied animals with a hard, coiled shell. Very small snails can be quite plentiful in lawns, especially ones around 1/16 inch. Food: fresh and decaying plant material.

Slugs

Look like snails without shells. Both snails and slugs travel on a slippery substance that they secrete; they thus leave a track where they have been. Food: fresh and decaying plant material.

Earthworms

Segmented worms with a large band around the body about 1/3 of the distance from the head. Size varies from 1 inch to over 6 inches. Earthworms are very numerous in lawns, frequently come up after the lawn is watered or at night. Food: scavengers; eating material in soil.

ADAPTATIONS

For the Blind:

Although successful with all levels of children, the games in this section were originally developed for blind youngsters.

Youngsters can map out their quadrant by using string and rulers with raised gradations, which are available in most stores. Although it may take a little time, these youngsters should be able to get a good idea as to the physical setting of their area, the vegetation and the soil.

For the Physically Handicapped:

Not only do the games in this section provide a valuable learning experience, but they also provide practice in motor co-ordination skills.

Grow plants from seeds for observation, to beautify a room or for fund raising.

For the Mentally Handicapped:

To help these youngsters learn the parts of a flower, draw each part on a different color of construction paper. Let the group members cut them out and paste them on black paper.

Activities I and II work particularly well with the mentally handicapped, although the vocabulary may have to be modified or explained in greater depth.

Each youngster could also be given a rectangular pot and some grass seed. Caring for his own plot of grass may help him to understand how physical factors (water, soil, lighting, etc.) influence the growth of living things as well as giving him a sense of pride in keeping something alive.

For the Deaf:

Plants can be used to develop concrete observational skills in the six-to-nine-year-old deaf child. They can speculate in what are seeds and what are non-seeds. Strips of paper can be used to measure the growth of plants and later these strips can be used to develop an understanding of graphs. Questions originating from the youngsters as to why something has happened should be referred back to the child for further experiments and inquiry.

The Lawn Study should be repeated several times over the year for the nine-to-twelve-year old deaf youngster to increase his observational skills. Maintaining a year round record of changes (there are observations to be made in the winter) will help him learn to organize materials.

See also suggestions for deaf children in Soil Section.

Nature Hikes

NATURE HIKES

Nature hikes can be exciting adventures for both young people and adults. However it is up to you as the leader to encourage this spirit!

Hikes do not have to be one-time outings. Experience the woodlot or the beach before breakfast when the sun is rising and again after dinner when the sun is setting.

Avoid long hikes on very warm days or around mid-day when the sun is the hottest. Advise the youngsters to wear shoes that will protect their feet as well as ones that will stay on (no thongs, please) and clothing befitting the season and temperature.

As a leader, you do not have to be a naturalist to lead the hike. The ability to rhyme off the names of all the animals, plants, trees, birds and insects is nice to possess but is not nearly as important as being able to get your youngsters to see, touch or smell the environment. Young people will never remember the names of all the things they see but will remember how nice a flower smelled or how rough a piece of bark felt. Your basic goal is to encourage greater observations and insights.

Always carry a bag equipped with crayons, paste, a magnifying glass, rubbing paper, string, etc.

Guidelines

Begin the hike by reminding the group that they should not pick wildflowers, break branches from trees, crush toadstools and mushrooms, destroy spider webs or step and run through the woodlot

without looking out for the tiny, new trees that are trying to grow in the soil. In other words, they are going to be quiet, courteous, and aware that they are guests of nature. All they should leave along the way are their footprints.

The general approach that should be used is frequent and short stops along the way which will depend on the group's interests and their attention span. Stop every time you notice well-known trees, plants, insects, unusual patterns or designs in tree bark, animal homes, birds and bird nests, animal tracks or feathers. In other words, point out to the youngsters the world they are living in.

Look for colors, light and shadows. Look for size comparisons like a tall tree and a tiny seed; a child and an ant. How many different shapes of leaves can you see? Are there any baby trees (saplings) growing along the trail? Are they the same species as a nearby living tree?

Feel lichen growing on a tree and compare it with the feeling of moss. Feel the bark of several different trees. How is it different? Describe.

Smell the leaves on the ground. Then smell the leaves from a nearby bush. Do they smell the same? Why not?

Look at tree branches in the winter. What do they tell us about themselves? (See section on trees.)

Does snow look and feel the same in all parts of the woods?

How much light is coming through the trees? Lie down on your backs and imagine you are young trees (saplings) trying to find the sunlight. Is this a good place to grow? Try to find a better home.

Listen for bird calls, wind and rustling leaves. Which sound is the loudest? If you were a rabbit, where would you want to hide along the trail? Pretend for a moment that you are going to move into the forest, where would you make your home? How many different kinds of insects can you find on the bark of a tree? How many can you find on the ground underneath the tree? Look underneath rocks for life but remember to turn the rock back over the way you found it.

Allow the young people to explore and no doubt you will be surprised at how observant they become. Let them tell their adventures to other member of the group and to point out their precious finds.

Walk along the same trails in all the seasons. Notice the changes. Try to walk through contrasting environments such as an open field in comparison to a dense woodlot; a swampy area and the beach; along a road in comparison to a forest's edge. These diverse habitats will maximize the possibilities for an enjoyable and happy hike.

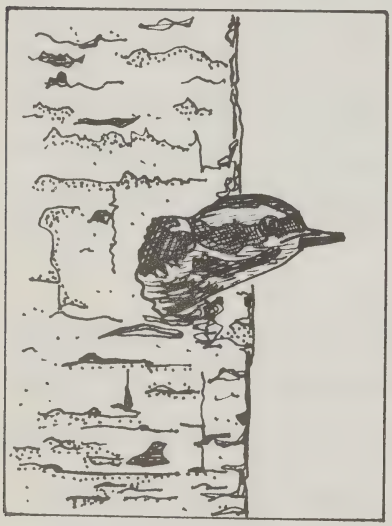
Perhaps you would like to design your hike around a particular area of interest, for example:

A. Animal Signs:

Even if you can't see or find an animal you may still be able to detect its presence by hunting for tracks or footprints, particularly if the ground is soft.

If you find a feather, you know it must come from a bird.

Spider webs are ordinarily hard to see but you may notice one if you go out early in the morning when tiny drops of dew catch on the webs and make them shimmer.



Holes in the ground usually indicate animal homes. The size can give you a clue as to the type of animal that may live there. Obviously, a mouse does not need a hole as big as a fox.

A fallen log may house an animal, maybe even a fox. The outside of the log may provide a home for insects under loose pieces of bark. If you turn over the log you will often find grubs or beetles.

B. Wildflowers:

There are many different kinds of plants that grow in the woods. Two very common types are violets and lily of the valley. Violets are usually purple or white and have a very sweet smell. The Lily of the Valley has fluffy white blossoms and rounded green leaves. Although it has the same name, it is not the same plant as the flower

that grows in people's gardens.

Different kinds of flowers grow in different parts of the woods. The yellow cowslip grows in very wet places. Other flowers such as the tiny pink Mayflower grows where it is dry. Sometimes you will even see flowers growing out of rocks.

Some flowers need more sunlight than others and tend to grow in clearings. Buttercups and daisies are examples of these.

Violets, which don't like a lot of sunlight, grow in the shade provided by thick trees. The liverwort grows in rocky, shady areas. Mayflowers grow close to the ground often under leaves.

Can you see any difference between the kinds of flowers that like lots of sun and those that do not?

Many of the flowers you find in the woods in the spring will bear fruit in the summer of fall. The wild strawberry has small white blossoms in April or May. By mid-June the blossoms have turned into sweet red berries.

Blackberries also have a white blossom, a little bigger than the strawberry blossom. Strawberries and some blackberries grow close to the ground. Cherry trees have fragrant white blossoms that look like strawberry blossoms. Apple blossoms are larger and are usually pink, with an even sweeter smell.

One of the most interesting things about wildflowers is their names. Many have names that tell what they look like.

Dutchman's-breeches is a small white and yellow flower that looks like a pair of pants. Adder's-tongue is a long yellow flower with a tongue sticking out of the middle of the blossom. A Jack-in-the-pulpit looks like a little green man standing in a green pulpit with a roof over his head. Indian pipes are straight, smooth and white like pipes.

What do the names Pussywillow and Skunk Cabbage tell you about these flowers?

Find some flowers and make up your own names for them.

Please note: Wildflowers are happy where they are. Don't pick them or try to transplant them unless you are working with a group of children you will never be able to see these flowers up close. It is too easy to strip an area of its natural flora and fauna, thereby ruining it for future visits.

Non-flowering Plants:
Not all plants have flowers. Moss is a short, fuzzy, green plant that covers the ground like a thick green carpet. It also grows on rocks and trees. Some people think that moss grows only on the north side of trees. Take a look. Do you agree with this?

Lichens are actually two organisms - a fungus and an algae - living together for mutual benefit. They grow where other plants do not furnish competition. They are found on rocks, trunks of trees, logs, sand and bare soil. These flow-growing, long-living, sun-loving plants flourish in code, dry climates, in forests and on mountains - wherever the air is clean and unpolluted.

Ferns are graceful plants with long curving stems and delicate green leaves. A full-grown fern looks like a green feather. Very young ferns tuck around in tight coils, which straighten out as the fern grows bigger.

Many mushrooms are smooth-skinned plants shaped like short fat umbrellas. They often grown in damp places in the woods. Mushrooms are usually gray but some are pale orange or tan, or other unusual colors. It is difficult to tell which mushrooms are poisonous and which are safe to eat so it is best not to try any.

Poison ivy and poison oak are two other non-flowering plants to beware of. Many people develop itchy blisters on their skin when they touch these plants. A wise rule to remember is "leaflets three, let it be."

For information on the trees, insects and birds, you may find in the woods, see other sections.

Art Activities:

The Indians and colonists used the natural materials in the woods to get their colors for dyes. Find as many things in the woods that you think might give a color and try them on pieces of paper.

Make a rubbing or a plaster cast of as many different shaped leaves as you can find.

Things in the woods feel different. Some feel smooth and some feel rough. Find something that is smooth and something that is rough and make some rubbings of them.

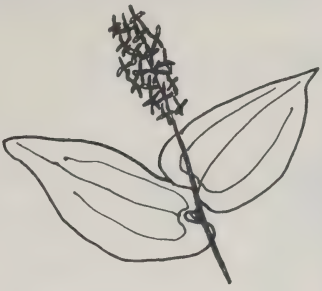
There are many animals in the woods. Most are hiding. Some come out to hunt at night. Some live under rocks or in dead logs. See if you can find one and draw a picture of it from below. Show how it looks from the sides. See if you can find the name of the animal in a book and write its name under your drawing.

In the fall most plants produce seeds. Inside you will find a baby plant. Find as many different kinds of seeds as you can and paste them in your notebook.

For other art ideas and to learn how to make rubbings and plaster castings, see "Arts and Crafts" section.

SOME COMMON PLANTS

VIOLET



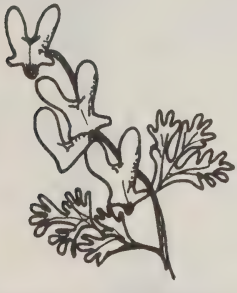
LILY OF THE VALLEY

MARSH MARIGOLD

BUTTERCUP

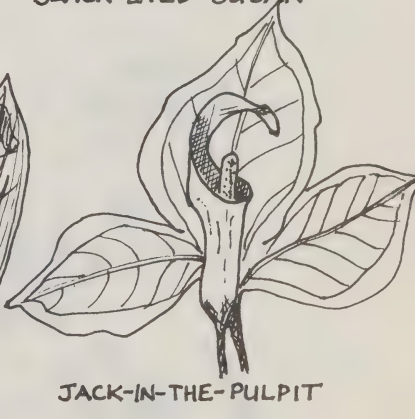
DAISY

BLACK-EYED SUSAN



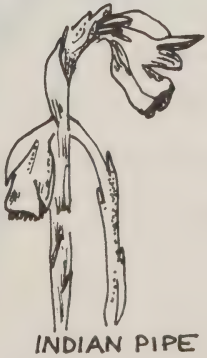
DUTCHMAN'S-BREECHES

ADDER'S-TONGUE



JACK-IN-THE-PULPIT

PUSSY WILLOW



INDIAN PIPE

POISON IVY

POISON OAK


SOME COMMON ANIMAL TRACKS
COTTONTAIL RABBIT
10 cm. ±
hind
fore
left fore
RACOON
11cm.
left hind
SQUIRREL
6cm.
DEER MOUSE
2cm.
fore
SKUNK
hind
6.5cm.
4.5cm
CHIPMUNK

ADAPTATIONS

For the Blind:

Field activities are especially enjoyed by the blind. They can climb, wade or hike as far as anyone. In addition, they tend to notice things in an area that other youngsters miss, such as the number and kinds of birds, the odors that vary with every location and the changes in the earth beneath their feet. These children are perfectly capable of identifying trees and other plants.

Try this sensing game: have the youngsters sit on the ground and contribute an observation about something he senses in the environment. Observations may not be repeated. (Non-blind youngsters can participate by closing their eyes.)

For the Physically Handicapped:

It is possible to undertake this activity using pathways through treed areas. However, it is important that the trail be checked beforehand to see if it is appropriate for use by youngsters in wheelchairs or with crutches and braces. There should be few curbs, a gradient of less than five percent and the surface should be hard, smooth, wide enough to accomodate a wheelchair or the various spreads of crutches and level as the smaller front wheels of a chair tend to get easily caught in ruts and holes.

Games could include a "scavenger hunt" and "Kim's Game" using natural objects -- don't ask for too many articles. "I spy" could be limited to natural objects such as flowers, trees, etc.

An "unusual nature hike" also provides a lot of fun, although it does require thought and preparation beforehand. Along a planned trail place natural items that don't belong in that spot. Try a banana tied to an evergreen, an orange on a log, an artificial bud. See how observant the youngsters can be. End with a candy tree which carries small suckers for everyone.

Encourage youngsters to make a collection of small natural objects, such as cones, stones, burrs, etc. A later project would involve placing a little plaster of paris in each cup of an egg carton and putting in the nature items. Be sure and write on the carton, the dates and locations where the objects were found and the name of the finder. These boxes will be great for later reviews.

Snow

SNOW

Snow crystals form in clouds where temperatures are anywhere from 0 C to 37 C (32 F to -35 F). These clouds are made up of water droplets so small that thousands could fit on the dot of an i. We see them as a cloud only because such vast numbers are concentrated in one area. Along with the droplets are minute particles of dust and salt from the surface of the earth and the sea that have been carried miles up into the sky by the prevailing winds.

These cooled particles have the ability to attract water molecules from the small droplets in the cloud. As these molecules gather on the particle, they freeze and build ice crystals. This is the start of the snowflake or snow crystal. In its earliest form, a snow crystal is merely a plain hexagonal shape of transparent ice.

As the crystal falls through various layers of clouds in the atmosphere, more water molecules stick to it and form six arm-like extensions. Ice fills in the empty spaces and the process continues - six more extensions, spaces fill in, etc. As the crystal gets closer to the earth, it grows more rapidly due to the increasing amount of water droplets created by the warmer temperatures.

The crystal then falls through the nimbostratus clouds (layers of scraggly-looking clouds) where temperatures are between -15 and -20 C (5 and 10 F). It continues to float back and forth, continuously growing until it reaches about 0.4 cm or 3/16 in. in size and is heavy enough to fall to the earth.

NEW SNOW

ACTIVITY I

1. Catch a snowflake on your mitten. Look carefully. Is each snowflake the same? Are there basic types of snow crystals? Do any of the flakes appear broken? What may have caused them to break?

ACTIVITY II

Make slides of snowflakes.

Equipment:
- projector slides
- cardboard
- hair spray
- slide projector

1. Store the slides and spray in the freezer until a snowfall.
2. Put the slides on a piece of cardboard and quickly move them outside before they have an opportunity to warm up.
3. Spray a thin coat of hair spray on slide and hold slide out in the snow until several flakes have fallen on it.
4. Leave the slide outside in the cold for one hour - away from the falling snow.
5. When the slides are dry, bring them inside for viewing.

OLD SNOW

Although snow falls as delicate crystals, it is transformed into granular crystals due to an evaporation and recondensation process - the fine points evaporate and this evaporation causes the air around the crystals to become moist. The moisture then recondenses

and deposits particles of ice on the flatter, smoother crystal surfaces.

Smaller, rounder crystals are easier to ski and toboggan on because they roll under a moving object in an easier manner than do the more sharply-edged new snow crystals.

ACTIVITY III

Look at piles of old and new snow and note any difference in their shapes. Did the snow closest to the ground (old snow) fall in the same shapes as it is in now?

SNOWDRIFTS - SHAPE AND STRUCTURE

ACTIVITY IV

Select a drift with a good shape and an overhang called a cornice. Using your ruler slice the drift so that a cross-section is exposed. Sketch the drift and indicate by observing the flowing snow, and using direction arrows, how the wind forms the drift. Use circular arrows to indicate eddy currents.

Look for layers of thick or thin, clean,

dirty, icy or crusty snow in the cross-section. These layers are called strata. What may have caused these layers? How many layers are there?

TEMPERATURES

Because of the reflection from the snow's shiny crystals and the air spaces between the crystals, heat cannot move through the snow. Thus snow is a good insulator.

A layer of snow covering the ground will keep the temperatures of the soil beneath it fairly constant during the winter, even if the air temperature hanges greatly. On a very cold day, the snow helps maintain a 17C or 68F between the air and the soil. On a warmer day, the snow keeps the soil cooler than the air.

ACTIVITY V

Using your drift cross-section, take temperature readings at 5 different depths by inserting your thermometer horizontally into the side of the drift. Measure the position of the thermometer from the top of the drift and indicate it on your drift diagram.

Insert the thermometers as far as possible into the drift.

Position	Depth of Thermometer	Temperature
1.		
2.		
3.		
4.		
5.		

When you return indoors plot a graph of depth vs temperature. Compare your results with other groups.

Dig down to note the condition of the soil. Is it frozen or not? What is the color of the grass? If the snow is frozen and if plants cannot grown when they are frozen, how do spring flowers grow through the snow? (Answer - the soil is not frozen.)

Try to find the warmest or coldest spot in your yard. Why is it the warmest or coldest?

SNOW DENSITY

Things to think about:

1. Which melts faster, an ice cube or snowball both weighing the same amount?
2. How many cups of snow are needed to make one cup of water? (freshly fallen snow has a lot of air between its crystals; it may, therefore take up to ten cups of snow for one cup of water.)
3. Will 30 cm or 12 in. of newly fallen snow still measure 30 cm or 12 in. in depth a week later?
4. Stick a snowball on the end of a pencil. How long will it take for the first drop of water to fall off. (The porous nature of snow allows water to soak in between the crystals. It may take up to one hour for the drop to fall.

SNOW AND POLLUTION

As snowflakes fall through the atmosphere, they may pick up dust and small particles emitted into the air by industries or residen-

tial chimneys. Snow lying near roads and parking lots may also become dirty due to the pollutants from car exhaust systems.

ACTIVITY VI

1. To test the purity of the snow in your area.

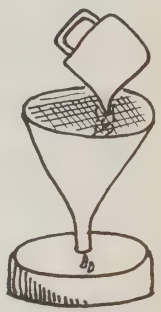
Equipment:
- clean container, saucer or glass
- filter paper or paper towelling
- funnel
- clean jar or container
- magnifying glass

Method:

1. Wait until a snowfall and then collect snow in the container. Cover the top so that no dust will settle into it and wait until the snow melts.
2. Examine the paper towelling for any specks and then place it in the funnel.
3. Pour one-half of the melted snow through the towelling and funnel into the jar.
4. Examine the towelling and/or filter paper with a magnifying glass.
5. Compare the melted water with the filtered water.

Questions:

Why is it important to examine the filter paper before pouring the melted water through it? What can you see on the filter paper? What do you think caused the particles on the filter paper? What differences can you see between the melted water and the filtered water?



You may wish to continue this experiment by collecting snow from various areas of your property and comparing it.

TRACKS

Sketch briefly at least five different tracks that you can find. At least two and preferably three should be animal. Indicate the direction of travel with an arrow.

Can you find the track of an undisturbed animal, such as a rabbit or a dog and compare it to a running animal? Measure the distance between the different tracks.

OTHER WINTER ACTIVITIES

1. Collect weather data.
2. Write a poem
3. Make a collage about snow.
4. Using tempera paint and a container with holes in it to make a snow painting in the yard.
5. Take a good look at trees (see Section on Trees).
6. Look for winter insects (see Section on Insects).

ADAPTATIONS

For the Deaf:

Snowballs provide an excellent learning opportunity for the young deaf child to actively pursue information about melting, heat insulation etc. Have each child make a snowball; bring it indoors and try to keep it from melting. You should be able to obtain quite a number of suggestions. Let the children experiment!

The facts about melting, insulation, etc. are secondary to getting the children to seek out new information and to develop their problem-solving ability.

For the Mentally Handicapped:

These youngsters often enjoy making snowflake cutouts and they can achieve good results.

Soil

SOIL

Soil is an extremely important life-support system. It provides homes for millions of organisms as well as providing us with food. Yet the average person's knowledge of this natural resource is rather limited.

There are several interesting and educational activities regarding soil that can be carried out around the backyard or the campsite.

ACTIVITY I

1. Using a spoon or trowel collect samples of soils from various spots around the backyard (from under a tree, from the front yard and the back, under a bush, near some flowers, etc.)or from a forested area. Place each sample (three or four handfuls) on a sheet of paper. If you find some dead surface vegetation, such as leaves, taken them along also.
2. Thoroughly examine each sample. Look for similarities and differences in the color, grain size and smell. If you wish to find out the type of soil you are examining, fill out the soil comparison chart on the last page of this section.

Questions:

A. What is the soil made of? Did you see anything that makes you think that the soil is made of these materials? (If the youngsters do not suggest that rock crumbles into soil, ask questions such as: What happens when you rub two stones together?) What causes the rock to break down into soil? Can you find any rocks which show signs of weathering? Are there any particles present? What are they? Were these particles always this size

or have they changed? If you think they have changed, how did this change occur? What else, other than rock is needed for soil?

(Answer: decaying leaves, wood, dead organisms are also needed.)

B. Ask the group to describe what their soil looks like? How does it feel? Squeeze a handful of soil: compare the texture, the way the soil holds together. When you press a large piece of soil in your hand does it squash, or does it break up easily, or does it require more pressure? Why? What differences can you see between the different samples of soils? (Color, texture.) What do you think causes these differences?

C. Smell the soil: Does it have a smell? What does it smell like? What do you think causes the soil to smell? Take a handful of soil from near the surface. Squeeze it, holding your hand near your ear as you do so. Do you hear anything? Describe what you hear.

D. If you were going to make the very best possible soil for growing plants and trees, what would you put in it? Why? Are rock particles of any value to the soil? Why? Are animal particles of any value to the soil? Why? Are plant particles of any value to the soil? Why?

BACKGROUND INFORMATION:

A process called <u>weathering</u>, causes rocks to break down into soil particles. Weathering is the physical and chemical decomposition of materials by the elements. It includes such things as the

action of rain or waves beating on rocks; rivers or streams rubbing away particles of rocks; plant roots breaking up pavement and rocks; the expansion and contraction of rocks because of temperature variations and the freezing of water in rock cracks causing cracks to get bigger.

Decaying leaves, wood, and animal matter, called humus, also make up our soil. Humus in the soil is very important as it helps the soil to hold water - thus providing plant life with water and decreasing the amount of water that runs off the land. Soil rich in humus resists drought conditions and the problems associated with water erosion.

Although soil is made up primarily of two components - rock and humus - we do have different types of soil. This is because rock types may vary (for example they could be sandstone or granite) and the types of humus can change (leaves from deciduous trees form different types of humus, than do coniferous leaves). Obviously too, the proportion of rock and humus change.

The rock portion of the soil determines the color, grain size, and texture of the soil. The smell and color are determined by the humus content.

ACTIVITY II

Another way to differentiate between soil types is to test the water percolation rate of the soil samples. In other words, by checking how long it takes water to ooze or trickle through the soil, you can see which types of soil are able to hold moisture

better than others.

Equipment: an empty tin can - remove top and punch six holes in the bottom
a watch with a second hand
a measuring cup
water

1. Fill the empty tin can half full of soil. Hold the can at waist or shoulder height and pour three quarters of a cup of water into the can.
2. Using the second hand of the watch, record the time it takes from when the water is first added to the can to when the first droplets pass through the holes in the bottom.
3. Repeat the experiment with other samples and compare the differences.

BACKGROUND INFORMATION:

Soil can be divided into three types: sand, silt, and clay. The soil particles vary in size with the clay particles being the smallest - under 0.002 mm in diameter. The silt particles range from 0.002 to 0.05 mm and the sand from 0.05 to 2.0 mm. Anything larger than this is considered to be gravel or stone. (Most soils contain a mixture of the three types.)

The amount of open space between the particles affects how easily water can move through that type of soil and how much water the soil will hold.

For example, soil which consists mainly of clay takes in water very slowly and gives the water up to the plants very slowly. This

type of soil is sticky when wet.

On the other hand, sandy soils that have little clay or silt particles to fill up the pore space cannot hold much water. Crops cannot live long in this type of soil unless there are very frequent rains.

Things to think about:
In the soil, you will most likely find plant roots and small animals. The roots anchor the plants growing above the surface and provide them with food (minerals from the soil) and water. Small animals move through the open spaces in the soil to find food, shelter and water.

Do you think plants and animals could easily survive in soil which is entirely sand or entirely clay? Why or why not?

What happens when rain falls on the different types of soil? If the water does not run into the soil, or evaporates it back into the air, it may run off carrying soil particles with it. This is called erosion. How can you prevent erosion?

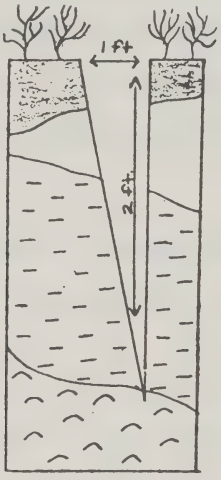
ACTIVITY III
Taking a close look at a soil profile is also an interesting activity. You may find one on a hillside where road construction or erosion is occurring or you may have to dig your own.

Use a spade to dig a hold 30 to 60 cm or 12 to 24 in. deep depending on the thickness of the upper layers. Try to make one side

of the hole as straight as possible. You will notice layers of soil of different colors. The layers are known as horizons and all the horizons form a soil profile.

Questions:

Does the color of the soil change the deeper you dig? Does it feel the same as you dig deeper? Does it look the same as you dig deeper? How far down do the roots grow? Do you think that all soil profiles look the same? Why?



A Typical Soil Profile

A Top soil layer, dark brown in color (several inches)

A2 Zone of leaching, light brown in color

B Zone of accumulation, reddish-brown in color (several inches - several feet)

C Parent material, grey brown in color

BACKGROUND INFORMATION

The formation of soil horizons is caused by the movement of the plants and animals within the soil. They also add humus to the soil. In addition, the finer particles of soil are carried down to lower levels by water.

Additional Activities:

1. Following a discussion of the soil profile, ask the youngsters to construct one of their own by using cardboard, various kinds

of soil, twigs, leaves and glue.

2. Build a compost bin and examine the rate at which organic waste is broken down. Instructions follow.
3. Try to make your own soil by rubbing two pieces of rock together.
4. In the spring, examine the organisms which live in the ground by making a wake-up garden. See instructions in Arts and Crafts Section.

SOIL COMPARISON CHART

CHARACTERISTIC	SAND	CLAY	LOAM +
Soil sample site	_____	_____	_____
Color	light _____	medium _____	dark _____
Grain size	large _____	tiny _____	medium _____
Humus* content	slight (if any) _____	moderate _____	rich _____
Smell	none _____	foul _____	earthy/pine _____
When rolled through your fingers, it feels	rocky _____	dry: hard & plastic _____ wet: stiff & sticky _____	gritty _____
Speed of water flow allowed by the sample	straight through _____	allows very little, if any _____	moderate to slow _____

* Humus is the black or dark substance in soils formed by the decay of animal or plant matter that provides food for plant life.

+ Loam refers to a soil that has a good proportion of sand, silt and clay.

SIMPLE COMPOSTING OF DOMESTIC WASTE PRODUCTS

Composting is one means by which we can recover tangible benefit from our garbage and in so doing, reduce the volume of solid waste requiring disposal. It can become not only a hobby, but a beneficial and economical advantage to the home gardener or camp director.

The humus material from a compost heap has long been accepted as a soil additive and mulching agent which can be produced inexpensively in one's backyard. When added to the top soil, it improves texture, porosity, and water holding capacity and increases the organic content of the soil.

HOW TO COMPOST

Generally speaking, composting involves taking organic waste material and placing it in a soil culture rich in natural organisms. The extent to which one gets involved in composting depends entirely upon the individual and the availability of the materials needed. However, this is a simple, inexpensive approach to constructing a compost heap:

LOCATION:

You can locate your compost heap in an inconspicuous corner of your yard or you can choose a central site and decorate it to suit your landscape. However, be sure that the spot is airy and sunny. If you are thinking about building a composting heap at your cottage or camp, be sure that it is away from waterways and wells and at least one foot above the water table.

CONSTRUCTION:

Home composting is best done in some form of enclosure. Choose a size convenient to your needs, whether it's a three-foot square box or an enclosure ten feet on a side. The pile can be as shallow as one foot or as deep as five feet.

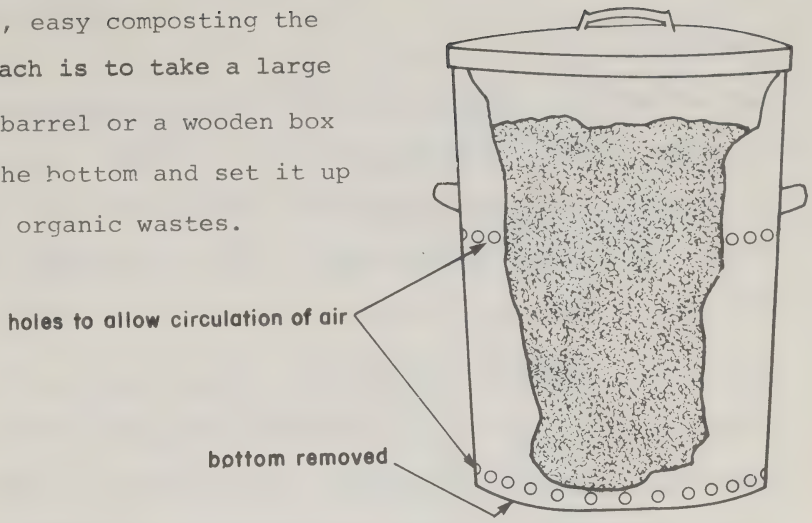
- Mark off a four-foot square on the ground and dig a pit between 12 inches and 18 inches deep. The pit provides some warmth in winter months and keeps the compost damp in summer.

- Drive four stakes approximately 2" square by 2' long into the ground at the corners leaving 1' of the stake above ground.

- From a sheet (8' x 4') of quarter-inch aspenite plywood, cut four 1' x 4' rectanges and nail them to the stakes forming a 4' x 4' x 1' enclosure. Leave a small space, about one inch, around the bottom so that air can circulate up through the heap. The remaining half of the sheet will be used as a cover for your heap during winter. In summer, a sheet of heavy gauge plastic placed on a 4' x 4' frame of 2" stock will be used as a cover. This will keep your compost heap from being a breeding ground for insects and will also help retain moisture.

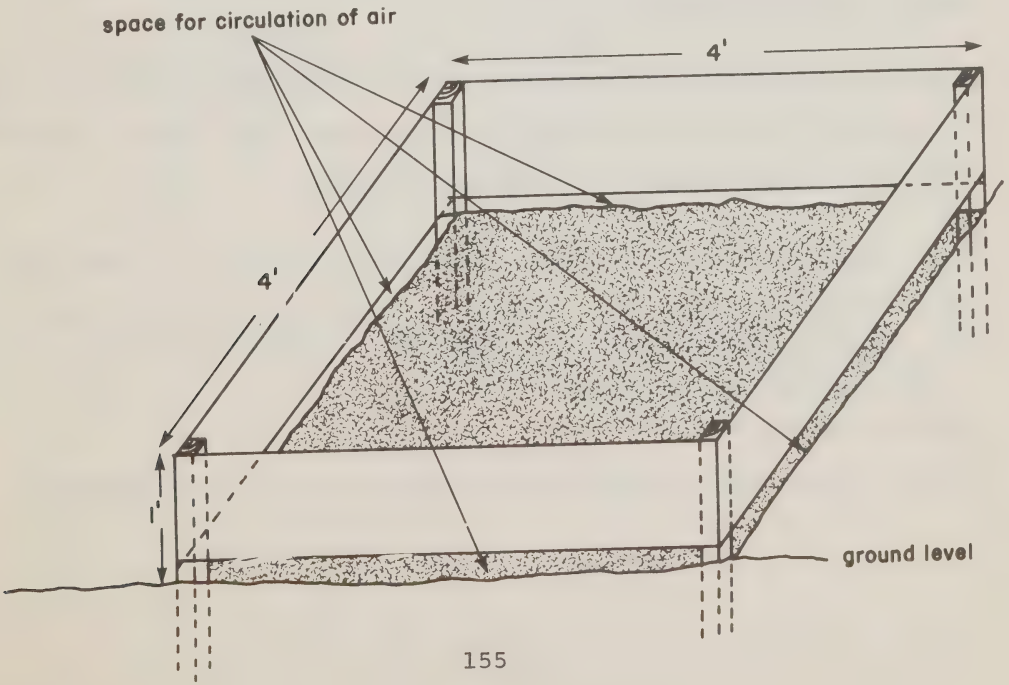
Simple enclosure:

For small-scale, easy composting the simpliest approach is to take a large garbage can, a barrel or a wooden box and knock out the bottom and set it up to receive your organic wastes.



Custom enclosure:

A composting enclosure can also be tailor-made in any size. These directions show how to build an enclosure four feet square rising one foot above ground level.



Your composting bin is now ready to receive your organic wastes.

COMPOSTING

Many methods for adding waste material to compost heaps are used. The simplest is to add material as it becomes available. Be sure not to add thick layers of finely ground material such as sawdust. These materials will pack tight and prevent adequate circulation of air.

Another method is to arrange your compost heap into layers by placing a thin layer of a commercial starter (or fertilizer) between each 6" to 8" of garbage. The starter is used to increase the bacteria count and the fertilizer will increase the nutrient content of your pile.

Whichever method you choose, remember that for your compost heap to function adequately, it must be kept moist but not soggy. Every two or three weeks the pile should be turned. This mixes and aerates the raw compost.

While the garbage is decomposing, heat is produced. This heat should be contained by covering the pile. Heat keeps the natural organisms functioning effectively to decompose the waste.

After every turning of the heap, heat again builds up. When the heat production stops, your compost is ready to be used as low grade fertilizer and soil conditioner.

WHAT TO COMPOST

Organic wastes are the main source of material for a composting

heap. These are everyday household ingredients which can be added to a compost heap:

kitchen garbage	* sawdust
vegetable and fruit peelings	pet waste
coffee grounds	* newspaper
*eggshells	barbeque grill residues
*clam and oyster shells	straw and hay
peanut and nut shells	garden residues
leaves	grass clippings

* acceptable in small quantities

With a little time and effort, and a minimum of expense, you can successfully reclaim some of your kitchen wastes in compost and reduce, at least in part, some of your camp's garbage problems.

For Further Information: Information Services Branch, 135 St. Clair Avenue West, Toronto, Ontario M4V 1P5

ADAPTATIONS

For the Deaf:

A simple way to assist deaf youngsters in the understanding of the variables met when dealing with the out-of-doors is to provide them with boxes of soils and a variety of seeds. A variety of set-ups should be used: a box in direct sunlight, in a dark corner; seeds in sandy soil, in rocks, seeds and flooding, seeds and no water. The children should be able to see that each setup gets different results, that physical factors can control the setup and that different kinds of seeds bring forth different kinds of plants. Logs consisting of drawings, maps and written statements will assist with language and writing skills. Let the group speculate about particular problems no matter how extraordinary the answers may be. Let them go back to their boxes and experiment to find the right answers.

For the Blind:

Studies involving percolation rate, soil textures and ground cover have proved very successful with blind youngsters.

For the Mentally Handicapped:

To make it easier for these youngsters to understand soil profiles, use colored chalk, heavy sandpaper and old pill bottles. Each member of the group sands the various colors of chalk and puts it layer by layer into the bottle. This makes a distinction between the layers that the youngsters can easily see.

Trees

TREES

Trees are considered plants because they make their own food and reproduce themselves. Under normal circumstances, they have a single, thick, woody stem or trunk.

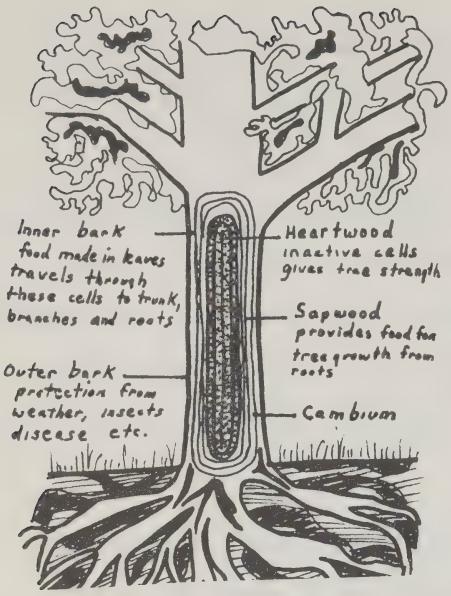
All trees have flowers. Some trees have very conspicuous flowers, such as fruit trees and the magnolia; other trees have flowers which lack petals and are thus harder to see, elms and some maples. Alders, birches, oaks, and nut trees have flowers called catkins. The dogwood has many small flowers surrounded by white or colored bracts.

The bulk of a tree consists of non-living material. Almost all the trunk is made up of dead tubes which carry water up to the leaves.

The living part of the trunk is a relatively thin cylinder just under the bark. Ring barking a tree, which is the removal of a complete ring of bark, will immediately kill the tree because no food will be able to travel down from the leaves to keep the roots alive.

The very centre of an old tree does not even carry water and often rots away to form a hollow tree which can grow quite rapidly as long as the outer section is healthy.

The tough outer part of the bark protects the growing layer, called the cambium, inside the trunk and branches from insects, fungi and other enemies.



Things to Think About:

How does the bark on different species of trees differ? Do the cracks in the bark run up and down or sideways? On all trees? Can you see different shades in the color of the bark? Is there any relationsiip between the texture and color of bark? Is there any difference between the bark in the top and the bottom of the tree? Does the bark on trees crack? What caused the pieces of bark to separate?

Make a plaster cast of bark and/or bark rubbing. See "Arts and Crafts" Section.

ACTIVITY I

Measuring A Tree - How Tall Is It?

Hold a pencil at arm's length vertically in front of you. Walk forward or backward until the bottom of the pencil matches up with the bottom of the tree and the top of the pencil appears to touch the uppermost part of the tree. Stand still. Do not change your position or tilt your head.

Turn the pencil into the horizontal position. Keep one end in line with the base of the tree and ask a friend to walk away from the trunk at right angles to your position. Tell your friend to stop

as soon as he or she appears to be at the end of your pencil.

The distance between the base of the tree and your friend is equal to the height of the tree and can be measured with a tape.

CONIFEROUS AND DECIDIOUS TREES

There are two main types of trees: conifers (evergreens) and decidious (broad-leaved trees).

Conifers

Conifers are also called evergreens because their needles do not appear to turn brown and fall to the ground at the approach of winter. Actually, conifers slowly loose their needles throughout the whole year. (The one exception is the larch tree, which sheds its needles every fall.)

Generally, coniferous trees have narrow needles and their wood is softer than those of broad-leaved trees. They are, therefore, also called softwoods.

These trees have both male and female cones which begin to grow in the spring. The female cones develop near the tips of new shoots and are red when they first begin to grow. The male cones are usually quite small and yellowish and are grouped in large clusters at the base of a new shoot.

The scales of the male cone carry the pollen sacs that are full of yellowish pollen. In spring, the wind carries the male pollen to the female cones (this occurs only in dry weather,which causes the female cones to open a little to allow pollen to enter) and

the small female cones begin to swell and become woody as fertilized seeds develop between the scales.

The seed itself has a thin "wing" growing from it and when the cones open the seeds fall out and are carried away by the wind.

Broad-leaved Trees

The leaves of broad-leaved trees differ in size, edging, color, vein patterns, texture, and arrangement on a stem.

In summer, the leaves act as reservoirs of water for the tree. Some of the water evaporates into the air and this forces the tree to draw up more water from the roots. When the leaves fall off the tree in the fall, the moisture left in the roots, trunks, and branches is preserved. Thus, shedding their leaves protects the trees.

(In tropical climates, hardwood trees keep their leaves all year round because there are long hours of daylight to prevent trees from withering. They are called broad-leaf evergreens.)

TWIGS, BUDS AND SCARS

Playing tree detective in the winter can be a lot of fun. By taking a close look at a tree after its leaves have fallen, you can find out where the tree will grow next spring, where the spring flowers will be formed, and where the new leaves will appear.

A young tree is called a sapling. A sapling grows higher and spreads its branches by lengthening the tips of its twigs.

Eventually the trees grow into branches by getting larger and thicker.

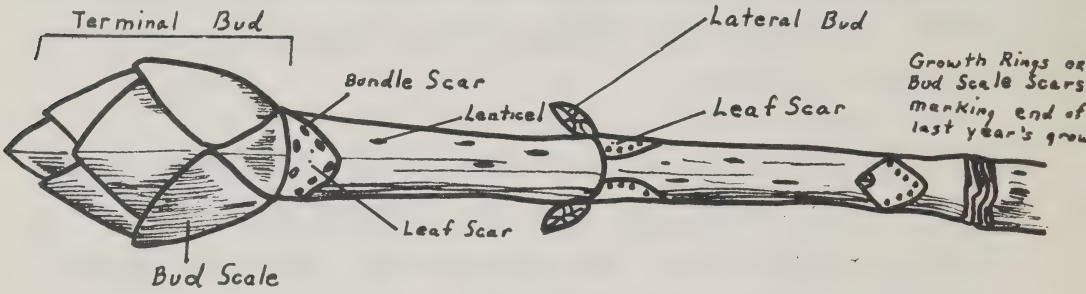
During the summer growing season, a bud forms at the end of most twigs. This bud is called a terminal bud. If you look back along the twig you can see lines around the twig, called growth rings or scale scars, that show where last year's terminal bud was located. By counting the number of these scars you can determine the age of your twig.

Along the side of the twig, you can also see the lateral buds. In the spring, these buds grow into new stems with leaves or flowers. (Usually the larger buds contain flowers, or leaves and flowers, while the smaller ones are leaf buds).

Most buds and twigs are alternate, appearing first on one side of the twig, then on the other. However, four common trees have their leaves and twigs in pairs or opposite each other. These are the maple, ash, dogwood, and horse chestnut. Remember mad horse.

Just below the lateral buds are small scars. These were caused when the old leaves fell from the trees.

If you look carefully at the leaf scars, you will see little dots known as bundle scars which are the ends of the veins which carried nutrients (food and water) to and from the leaf. The leaf scars and bundle scars make a pattern which is different for each species of tree. Some of them take on the appearance of faces.



Along the bark, there are tiny holes called lenticles, where the air passes in and out of the tree.

Activities

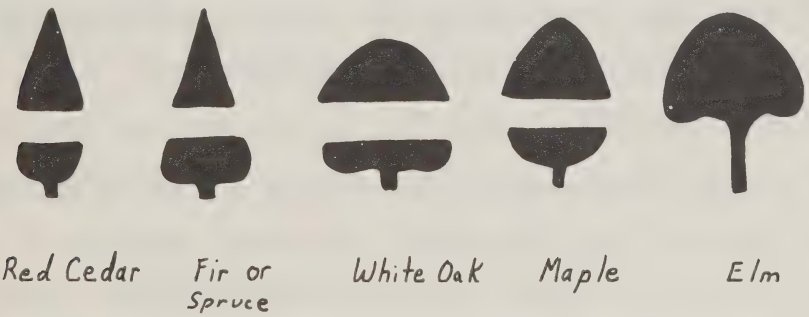
Find a twig that shows buds, leaf scars, bundle scars, scale scars, and lenticles. Do coniferous tree twigs have any of these features. Do you see the difference between a leaf bud and a flower bud? Are all twigs the same color? Are buds found on trees at all seasons of the year or only in one season? Is there always a terminal bud at the end of each twig? (Some trees do not have terminal buds. In these cases the twig keeps growing until the food supply falls off. The twig then dies back to the last lateral bud, which becomes a false terminal bud with a small round scar different from the leaf scars) at its base where the branch died back and fell off. These buds are usually set at an angle

(examples: linden, elm and sycamore). How does a twig change from season to season?

Carefully open a large bud and look inside. Are the buds hard or soft when squeezed gently? Do all buds have the same number of scales (except for the willow, which has a single, caplike scale that covers the bud, buds are usually protected by several scales)? Which buds develop faster, leaf buds or flower buds? Are there equal numbers of leaf and flower buds on a tree?

BRANCHES

Branches are the arms that give a tree its typical shape. Examining how the branches grow from the trunk is a good guide to tree identification.



Activities

Do more branches grow in one particular direction? If so, which direction? Does this pattern occur in other trees of the same species? How would other trees or objects such as buildings, affect the branch pattern? In what direction do the prevailing winds blow your tree? Compare the bud arrangement to the type of

branching in the tree.

How do we explain an evergreen's leaves? Look at a pine needle carefully. Where are the stomata, the little pores where air and moisture vapor pass in and out? Can the leaf cover these in winter? If you go into a conifer forest, you will notice a rather pleasant but strong smell. Find a tree which has been injured in some way. Something has healed it. We call it gum or resin. Cedar trees have an oil. Take a good look at some of this material on the bark of a tree. It is a clear liquid. How would you describe its scent? Spread some on paper. Be careful not to get it on your clothes or hair. Let it dry. Is it really waterproof? It protects the tree from infection by insects, or germs or spores which float in the air.

Crush some cedar leaves and sniff. Evergreen leaves have a layer of this waterproof material just under the tough surface. It prevents drying out.

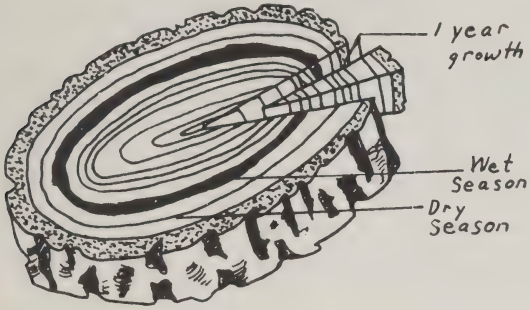
What are the advantages or disadvantages of the two methods, broadleaf (decidious) and coniferous (evergreen) trees use to protect themselves in the winter? Do evergreens hold their leaves forever? How long? (Look at a young tree for the answer).

Additional Comments

How old is a tree?

If you look at a cross section of a tree trunk, you will see that it is marked by a series of rings. These rings can tell the approximate age of a tree. Each growing season, a tree adds a

layer of new wood to its girth. During the cold months, when the sap eases to flow, growth is temporarily halted and the tree rests. Thus the rings are clearly halted.



Width of the rings varies from year to year with the climate. Dry seasons produce narrow rings; wet seasons, broad rings.

Do trees sleep in winter?

A tree which has lost its leaves is said to be dormant or "asleep". Its roots continue to grow, using food stored during the summer. On its branches, buds develop into tiny replicas of leaves and flowers. Each bud has its own storehouse of food and is covered with tough scales that protect the tender embryo leaves against loss of water. A few warm days and longer periods of daylight cause buds to open and develop. If warm weather comes followed by a cold snap buds may open up only to be killed.

SEEDS

A single tree may produce thousands of seeds every year. (The seeds of conifers are contained on the cones that hang from the branches. Apples and oranges contain seeds inside each piece of fruit. The seeds of nut trees are the nuts themselves.)

Each seed contains all essential elements to produce a new tree but usually less than one in a million survives to maturity.

Bugs and insects eat most while still on trees. Squirrels and chipmunks live on seeds of nut trees. Many seeds fall on barren or rocky ground. Only a few out of all the millions of seeds manage to germinate and put out tiny roots.

However, the little sprouts then crowd each other in their fight for sunlight and nourishment from the soil and only the hardiest survive. This fight for sunlight continues for many years. It has been estimated that in a single acre of natural pine woods, roughly 5,000 trees die after they are 20 years old.

LEAVES

A simple leaf has only one leaf on a stem and a compound has many leaflets on one stem.

Simple Leaf

A tree, like all plants, inhales carbon dioxide. The tree then breaks it down into carbon and oxygen. At the same time, the tree breaks down the water that comes from the roots into hydrogen and oxygen.

Compound Leaf

Then chlorophyll -- a substance that makes leaves and grass green -- acts as a chemical agent. Using sunlight as energy, it combines the molecules of the water and carbon dioxide and forms them into sugar, which is the food upon which the tree lives

and grows. The process is called photosynthesis. (The word is a Greek one coming from photo meaning light and synthesis, putting together.)

Why do leaves change color?

In cold weather while the tree sleeps, the chlorophyll is not needed for its work of changing air and water into food-sugar. As the chlorophyll fades and the leaf begins to slowly die, other pigments become dominant and the leaf changes color to yellows, reds, and brown.

Why do leaves fall off the tree?

The shorter periods of daylight affect a special layer of cells at the base of each leaf where it joins the twig from where it grows -- the stipule. In the fall, as the days grow shorter, this cell layer weakens and the leaf turns brown and drops from the tree.

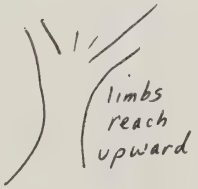
Activities

Collect and examine leaves. You will find plenty lying on the ground in the fall. Use an identification book and identify leaves by shape, texture and color. Make a scrapbook of as many different types of leaves as possible.

Make leaf prints, rubbings, and/or sun prints (see Section on "Arts and Crafts".)

TREE CLASSIFICATION CHART

By carefully recording the different characteristics of the trees you find and then looking up the name in a guide book when you return home, you can learn to distinguish one tree from another. This form could also be filled in by children before a field trip and used as an identification chart. In this case, however, the adult should list the names of the trees that may be found in the area.

Shape	Bark[1]	Leaves[2]	Buds[3]	Flower[4]	Fruit[5]	Outstanding Feature	Name
 limbs reach upward	vertical light and dark	 pointed tips	in a cluster  and pointed	long drooping catkins 	Acorn 	shallow acorn cap longish nut	Red Oak
	peeling scaly		large egg shaped 		Nut 	Shaggy bark	Shaggy bark hickory
							Sugar Maple

Note: Obviously, the seasons will influence which columns can be filled in.

1-5 -- for descriptions see following page.

1 Bark - texture and color

shaggy, in long, loose strips -- Shagbark Hickory

gray, mottled with yellow -- Sycamore

white, peeling -- White Birch

light gray, smooth -- American Beech

2 Leaves - note whether they are simple or compound leaves. (To distinguish a simple leaf from a leaflet of a compound leaf, look for the new bud at the base of the leaf stem.) Notice the edge as well as the whole shape of the leaf. Are the lobes rounded or sharp? What is the texture? Leathery? Crisp?

3 Buds - note the color, number of scales, texture and shape of the buds

4 Flowers - Conspicuous -- fruit trees and magnolia

lacking petals, harder to see -- elms and some maples

catkins -- alders, birches, oaks and nut trees.

many small flowers surrounded by white or colored bracts -- dogwood

5 Fruit - the structure which follows the flower and contains the seeds

fleshy fruit -- apple, cherry, pear

winged fruit -- maple, elm

cone -- conifer

nut -- beech, hickory

acorn -- oak

ADAPTATIONS

For the Blind:

Experiences which allow for personal involvement are extremely satisfying. Putting their arms around a tree and maybe sitting on a branch are good learning activities.

Tree leaves should be collected and carefully examined for texture, odour and other differences such as stem differences. The children should produce their own key for identification purposes. The same can be done with bark. (Note: use bark from dead trees or bark that is lying on the ground.)

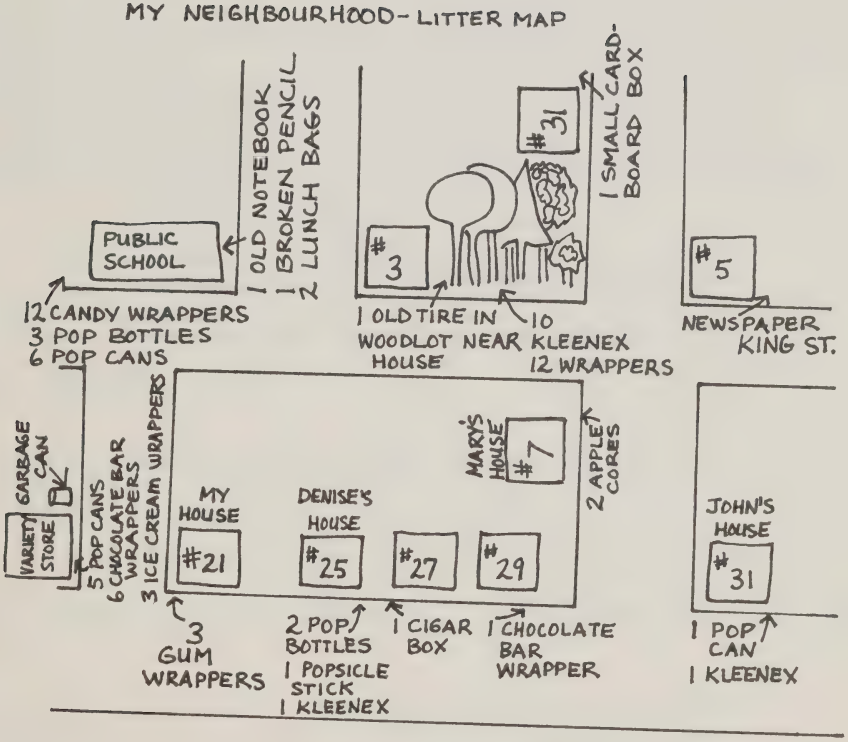
The diameters of various sized trees can be determined by using string that has the measurements marked off with tape. Map pins can be used to hold the tape in position while the youngster walks the other end of the string around larger trees. (Rulers with raised gradations are available in most stores.) Have the youngsters lay the string along the ruler to obtain the units of length.

For the Mentally Retarded:

The story of the tree, told simply, with diagrams of its roots, branches, bark, leaves and a cross-section, interests these youngsters.

A leaf collection mounted in a construction paper book is a fun project. Press the leaves, or wax them, before mounting them in the book with tape. Encourage the youngsters to continue bringing in different leaves to increase the size of their book.

Waste


MY NEIGHBOURHOOD - LITTER MAP
PUBLIC SCHOOL
1 OLD NOTEBOOK
1 BROKEN PENCIL
2 LUNCH BAGS
12 CANDY WRAPPERS
3 POP BOTTLES
6 POP CANS
#3
#31
1 SMALL CARD-BOARD BOX
1 OLD TIRE IN WOODLOT NEAR HOUSE
10 KLEENEX
12 WRAPPERS
#5
NEWSPAPER
KING ST.
GARBAGE CAN
VARIETY STORE
5 POP CANS
6 CHOCOLATE BAR WRAPPERS
3 ICE CREAM WRAPPERS
MY HOUSE
#21
DENISE'S HOUSE
#25
#27
#29
MARY'S HOUSE
#7
2 APPLE CORES
JOHN'S HOUSE
#31
3 GUM WRAPPERS
2 POP BOTTLES
1 POPSICLE STICK
1 KLEENEX
1 CIGAR BOX
1 CHOCOLATE BAR WRAPPER
1 POP CAN
1 KLEENEX

WASTE STUDY

Have you ever gone for a walk or a drive and been amazed at the amount of paper scraps, bottles and other rubbish you have found littering the sidewalk or highway?

Many children and adults are guilty of this thoughtless practice. They seem to think that the material will just disappear from sight.

LITTER

Activity I

To demonstrate what happens to litter.

Equipment: large glass jar or bowl filled with moist dirt
a metal barrette or paper clip
a piece of plastic
aluminum foil
scraps of newspaper
pieces of food - orange skin, apple core

Arrange the objects on the top of the dirt so that they can be easily observed.

Watch what happens to the objects over a period of time. Do they all disappear quickly? At the same rate? How does the container look? What would have been a more effective way of getting rid of the unwanted goods? Could any of those materials have been reused?

Activity II

Drawing a litter map.

Equipment: paper and pencil

1. Draw a map of a particular section of a street. Make it as

accurate as possible.

2. Search for litter in that area and mark its position on the map.
3. If the youngsters have mapped different sides of the street, have them exchange maps, and by using the directions on their friends' maps, have them find and pick up the litter.

Questions:

What areas have the most litter? By the bus stop? Near the local variety store? Who do you supposed dropped it? What can you do to make people stop littering?

Projects:

Write letters to the Works Department of the municipalities concerned and ask them to set up garbage cans in the areas that have the most litter.

Write letters to the local newspaper and make your feelings known.

Decorate a garbage can and set it up at all your meetings. Make posters.

GARBAGE

On the average, each man, woman and child in this country contributes four pounds of garbage a day to our disposal system.

In most areas, the garbage is hauled away once or twice a week by municipality to some sort of disposal facility.

What's wrong with that? The problem is that many of the goods which we put into the garbage are made up of natural resources which could have been reclaimed or reused.

Secondly, many of the current waste disposal practices either bury or send our renewable and non-renewable resources up in smoke. In addition, we lose the use of valuable land either permanently or on a long-term basis when we bury garbage.

Why not investigate the type of disposal method used by your community. Phone your local municipality to find out what type of a site they are using; how long it has been in use (if it is a sanitary landfill site, how much longer it can be used) and the location. Can you visit it?

A sanitary landfill site is an area where garbage is dumped and then covered over with soil every few inches and every night. This helps to eliminate health hazards and to reduce the smell. When full, the site is landscaped and can be used for recreational purposes.

ACTIVITY III

To demonstrate what happens to material in a sanitary landfill site.

Equipment: use the same equipment as in Activity I

1. Arrange the objects in the jar so that they are buried but can be seen through the sides of the jar.
2. Watch what happens to the material over a long length of time.

In some communities the garbage is taken to an incinerator where it is burned.

ACTIVITY IV

To simulate the action of an incinerator on garbage.

Equipment:
- aluminum pie plate
- paper
- rubber band
- piece of glass
- matches
- tongs

1. Using the tongs, hold the paper over the aluminum pie plate. Set fire to the paper. Observe what happens. Repeat using rubber band then glass.

Is there anything left over? Was there any odour resulting from the burning? Was there any smoke? If so, what color? What do you think happens to the garbage that can't be burned.

RESOURCE RECOVERY

It would be nice if municipalities could adopt improved methods of waste disposal which would eliminate the problems described above. However, plants such as the Ontario Government's Experimental Plant for Resource Recovery, which combines safe, effective disposal practices with separation and recovery of some of the reuseable materials, are still in the experimental stages.

However, there is still something that the individual can do to cut down on the amount of garbage which a municipality is forced to cope with. He can practice the four R's of waste management - reduce, reclaim, reuse and recycle.

Activities

Have the youngsters take a survey of the types of things in their families' garbage. What portion of the garbage is made up of paper? glass? tins? food? garden clippings? The garbage can in the school cafeteria could also be investigated.

Questions:

Could any of the discarded material have been reused? Could the broken items be fixed? Could any of the unwanted materials, such as paper, tins or glass be taken to a recycling depot? Were there any returnable bottles in the garbage? Could any of the food wastes have been disposed of in a compost bin?

Water

STREAM STUDY

From watching youngsters or adults at a pond or stream site, it is evident that some think throwing rocks or trying to catch minnows are the only interesting things that can be done in that environment.

How wrong they are! And how destructive! For in almost any body of fresh water, temporary or permanent, large or small, you have an aquatic habitat which provides the community that lives there with all of its basic needs for survival. This community is composed of animals and plants - some so tiny that we have to use magnifying instruments to see them - whose way of life can be easily disturbed by man's thoughtless actions.

There are a number of sharing and exploring activities which you and your group of youngsters can do at this type of unique outdoor area. These activities can vary from a short exploratory walk along the banks, a study of the physical characteristics of the stream, or an examination of the organisms (living creatures) dwelling on the surface, in the water, in the bottom sediment, or along the shore.

It's all up to you, the ability of your youngsters and the amount of time you have to spend.

Please note: It should be stressed to the boys and girls that they are only guests in the aquatic community and, therefore, they should return all specimens to the water as close as possible to where they found them. Overturned rocks should be replaced in their original position, and plants that are removed should be pulled

up with the roots intact and replanted after observations are made.

Choosing a Field Site

Any natural body of water can be used as an area of study since almost all will contain some type of life. Each lake, pond or stream is unlike any other so do not expect to always find the same plant and animal communities.

If you intend to undertake an in-depth stream study, pick your site carefully. You will need to wade in the water, therefore, the stream should be slow moving and shallow enough so that it does not present a danger. Avoid ecological or environmentally-sensitive areas such as waterfowl breeding grounds, sites where the shoreline is eroding, or areas with little or no shoreline vegetation.

A stream that has a very muddy bottom tends to become murky when you work in it and samples obtained are usually poor. A slightly stony and pebbly bottom is a good choice. An ideal stream is anywhere from 1.5 to 10 m or 5 to 32 feet wide and no deeper than 1 m or 3 feet.

ACTIVITY I

STREAM WALK

If you have decided to take your children on a walk along the edge of a stream or pond, please read the questions included in the Physical Features of the Pond or Stream, and Plant Life for some suggestions on topics of conversation.

ACTIVITY II

PHYSICAL FEATURES OF THE POND OR STREAM

Aquatic communities can be found in two areas: 1) in standing water, such as ponds, lakes and swamps, and 2) in running water, such as rivers, creeks and streams.

A. One of the factors which influences which animals and plants will be present at the site is water flow or stream velocity.

For example, organisms which must survive in areas where the water flows very fast must have some ways of protecting themselves from being swept away by the current.

The blackfly and riffle beetle larvae have sucker-like structures on their ventral surfaces to secure themselves to the bottom sediment. A flattened, streamlined shape allows the nymphs of stoneflies and mayflies to adhere to the undersides of rocks and avoid being swept away. Similarly, plants are equipped with strong, sturdy roots and thin pliant stems and leaves so that they won't be broken by the current.

In addition, a site which is composed of rapidly flowing water has an abundant supply of oxygen (the water tumbling over the rocks absorbs oxygen from the air) and thus the life existing there need no special features for removing oxygen from the water.

Conversely, at a pool site, where the water moves in large volume, its velocity is slow and the particles of sediment are be-

ginning to settle to the bottom, the aquatic organisms are faced with limited oxygen and the threat of being buried under the settling particles.

Many organisms, such as the tube worm, that exist in a pool site have special mechanisms to combat these difficulties. The tube worm builds itself a case in which it wriggles. The wriggling action increases the amount of water, which comes in contact with the worm so that the creature has new sources of oxygen. Its casing protrudes above the bottom sediment to prevent the organism from being buried by the settling particles.

ACTIVITY III

To measure water velocity:

Water velocity can be calculated by measuring the distance between two points in the stream and then timing how long it takes an object, such as a leaf, to travel between these points. The distance should be measured in centimetres and then divided by the number of seconds required to travel the distance.

distance between A & B in cm ÷ time to travel in sec. = velocity of a stream in cm/sec.

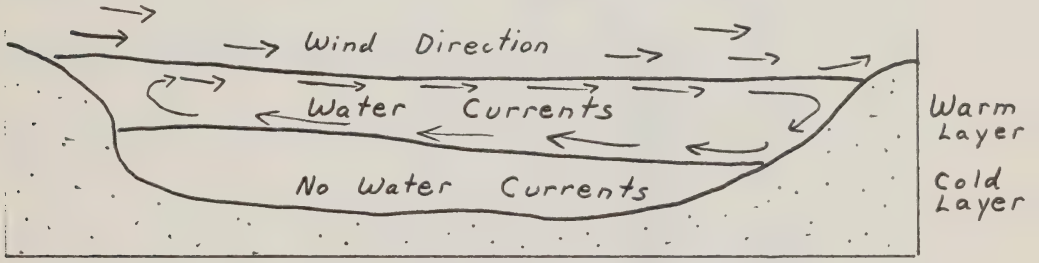
B. One of the major factors acting on a pond or lake is the climate which affects the temperature of the water.

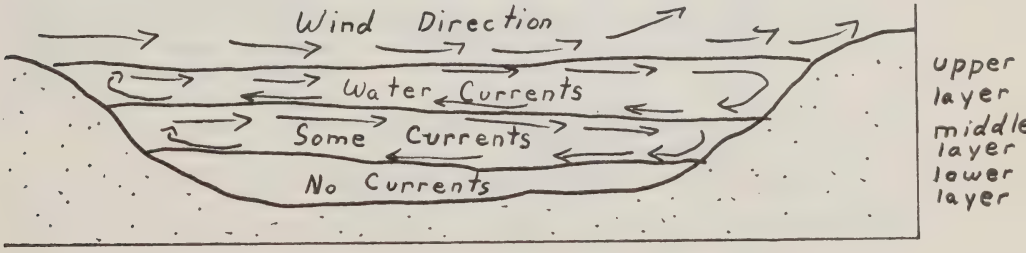
In the spring, the water is usually cold and therefore is able to absorb quite a bit of oxygen from the atmosphere making breathing easier for the fish.

As summer approaches, the sun warms the upper layer of water faster than the wind can mix it. The warmer water is less dense than the cooler water and tends to remain on top creating two distinct layers. Eventually due to water currents three layers form - an upper, warmer, freely-moving layer; a transitional layer; and, the cooler lower layer which receives no atmospheric gases.

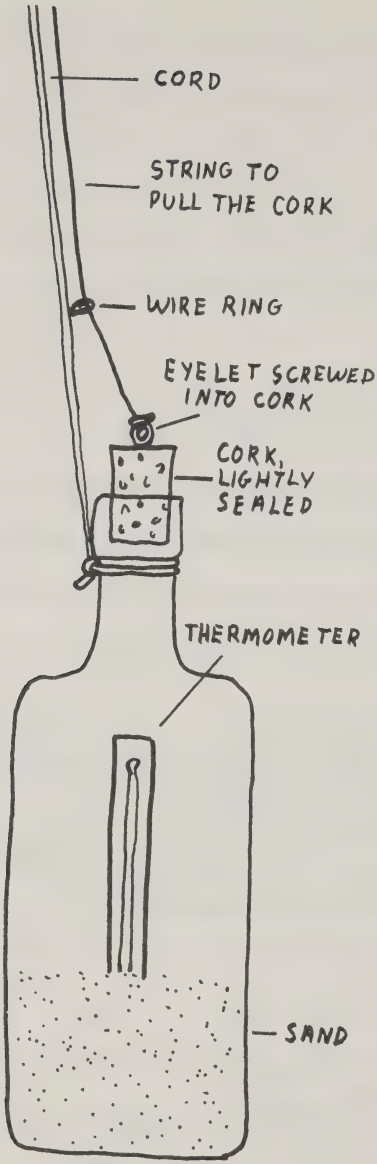
This layering is called stratification.

In most cases, the middle layer has the greatest amount of dissolved oxygen. This is because the organisms needing large amounts of oxygen are more abundant in the upper layer and tend to reduce the level of oxygen there.





As the autumn arrives, the water cools until the lake becomes uniform in temperature again.



When measuring water temperatures at various depths with this bottle device, mark the white cord with black paint at 1 ft. (30cm) intervals.

From "International Show-And-Do Conservation Project Kit", by the joint Conservation programme of the World Scout Bureau and the World Wildlife Fund.

During the winter as the upper water layer cools, it becomes more dense and sinks to the bottom. This continues until the colder water reaches 4° C or 39° F. Water colder than this remains near the surface and eventually freezes. Again, three layers form - the upper layer is ice and water close to the freezing point; the middle layer is again transitional but this time it goes from cold to warm and the bottom layer is warmer.

The temperatures and the amount of dissolved oxygen will again become uniform when the ice breaks up.

ACTIVITY IV

To measure water temperature at various depths.

Make and use the bottle depicted here. Lower the bottle to the desired depth. Pull the cork. Allow time for the bottle to fill with water and for the temperature inside the bottle to stabilize. Then raise the bottle quickly, and read the thermometer at once. Repeat the process at various depths.

C. Transparency refers to the clearness of the water. Substances such as soil, chemicals, bacteria, plant life, etc. which form small particles and become mixed or suspended in the water and do not disolve can make the water turbid or muddy. (Note: Turbidity is not always an indicator of pollution. A stream can be completely clear and still be highly polluted.)

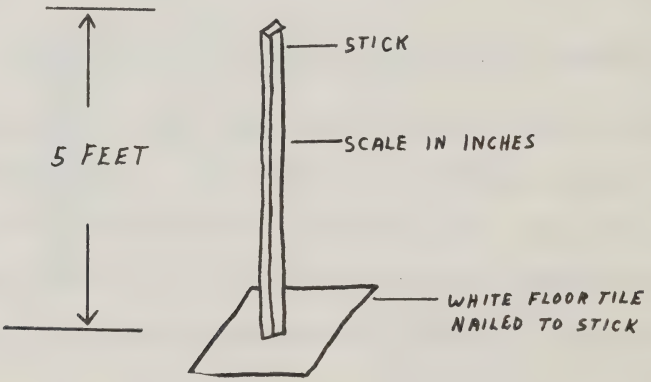
ACTIVITY V

To measure the turbidity of a stream or pond.

This test helps to measure how far down light can penetrate into a stream. Sunlight is one of the ingredients required by plants to produce oxygen (photosynthetic process).

Equipment:
- white floor or ceiling tile
- hockey stick or broom handle
- tape measure

Have the youngsters nail the tile perpendicular to the end of the stick handle. Mark a scale on the stick in inches or centimeters. Lower the tile into the water until it disappears from view. Measure the depth. Raise it slowly until it appears again. Measure this depth on the scale on the stick. The average of the two measurements can be used as an indicator as to the degree of turbidity.



To test deeper water for turbidity, paint a paint can lid white and punch three or four holes in the rim so that it can be lowered parallel to the surface of the water by string. Mark a scale on the string to read the depth at which the lid disappears and reappears.

Suggested Questions:

1. What color is the water? Is it clear , light brown, or dark brown? Can the bottom be seen?
2. What does the stream bank look like? Can you see any signs of erosion? Could the stream bank affect the color of the water?
3. Describe the surrounding country.
4. Estimate the amount of shade on the stream. Is it all shaded or half shaded? Why is it shaded? What sort of plants are growing in the shaded areas? Does the shade change the temperature of the water?
5. What is the weather like?

MICROSCOPIC POND LIFE

For this activity you will need lenses, basters (the kitchen type), sorting trays and clipboards.

One of the most fascinating aspects of animal life involves the discovery of microscopic plants and animals in the water sample. Most young people have not been exposed to these forms and are generally thrilled to discover them. The richest collections will be found in the fall and again in the spring.

ACTIVITY VI

Using the baster, have the youngster suck up a sample of water from:

1) the edges of pond or stream;
2) the scum of the surface of rocks or logs found close to the shore; and
3) close to the bottom mud.

Transfer these samples to separate sorting trays on shore. Have the youngster observe his samples with magnifying lenses and ask him to draw the specimens he sees.

When observations are completed, return the samples the water.

Suggested Questions

Do you see anything moving?

What color is it?

How fast is it moving?

How does it move?

Do you see any other forms of life?

Are they the same color? The same size? The same shape?

Are they plants or animals?

SMALL AQUATIC ANIMALS

You will need small hand dip nets, pails, small containers, sorting dishes and trays, clipboards, sieves and waterscopes. Instructions for building most of this equipment follow at the end of this chapter.

NOTE: In studying plant and animal life in water, scientists try to evaluate the quantity, ie the number of each particular species and the quality, ie the number of different species present. As pollution increases, the number of a particular species also increases, while the number of different species decreases. This change occurs because the pollution inhibits the animal life that would normally control that particular species. Therefore, the more variety in species you find in a stream, the less likely

that stream is to be polluted.

Some indicator organisms which can be easily recognized are:

1) clean water - insect larvae of May and Black Flies
2) partly polluted water - grey leeches of the non-blood sucking type
3) highly polluted water - aquatic worms. These animals require a very low oxygen supply in order to live.

The boys and girls will be able to find the animals and small aquatic animals on the surface of the water, on or under plants, logs and rocks, in the bottom sediment, and directly in the water.

ACTIVITY VII

Have the youngster look for insects such as the water strider on the surface of the water. Using the hand dip nets they can catch and put them in pails which are half-filled with water. Identify and record observations.

ACTIVITY VIII

Using the hand dip net, sweep it through the water around rooted vegetation. Put any captured specimen into the bucket. Look under the leaves of plants such as the water lily, and along the stems of plants for insects. They can be caught with the net and transferred to a pail. Identify and record observations.

ACTIVITY IX

Have the child turn over rocks and small pieces of wood in the water, and, using the waterscope, look closely for any movement. Common forms such as the mayfly or stonefly nymphs and leeches may be found.

Organisms found on the rocks can be washed off by holding the rock over the pail, and pouring water over it gently. Identify and record observations.

ACTIVITY X

Children are usually amazed to find living things in the bottom mud. They should be able to observe several organisms, particularly the bottom tube-dwelling worms.

The child can obtain a mud sample by either digging up the mud with the kitchen sieve or using spoons and placing it on the hand screen. Look closely for any movement. Fill the small container with water and pour it gently over the mud. Can you see anything? Pour several containers of water through the mud. Can you see anything? Pour several containers of water through the mud. The remaining sample can then be dumped into the paid (half-filled with water). The magnifying lenses may be of some help, if the child fails to observe any movement. NOTE: Many aquatic worms are small and are clear or have a very light coloring. Identify and record observations.

ACTIVITY XI

The small dip net can be pulled through the water, just below the surface and then closer to the bottom of the pond or stream. Con-

tents of the net are then to be transferred to the pail for observation and recording. The waterscope may be used here to observe the life as it exists naturally in the water.

Suggested Questions:
How do the insects found on the surface of the water move? What do their legs look like? Do they make particular noises? Do they ever dive into the water?

What color are the organisms that are found on the rocks? Why is this important? How do they attach themselves on to the rock? Is the rock green and slimy? Why is this? Why would a rock be a good place to live? What differences do you see when the organisms are held in the air (only for a few seconds, we do not want to harm them) and when they are put into the water?

What color are the organisms that are found in the mud? Why is this? What kinds of food would they find in the mud? Why is this? Where does it come from? Do you think these organisms could live on a plant or on a rock? Why not?

What makes the organisms which live throughout the water different from the other ones that were found on the plants? What do you think they eat?

LARGE AQUATIC ANIMALS
An ideal tool for collecting small fish is the seine (minnow) net. If this is available for use, an excellent fish study could

be undertaken. The net needs to be unrolled and placed across the stream with floats up and weights down, allowing it to take a U-shape. Bring the net towards the shore keeping the weighted bottom tight as it is lifted out of the water.

Fish, crayfish, and large beetles may be caught and can be transferred to a pail full of water. Identify and record observations. A fish's scales have observable ridges which can be counted as growth rings. Return all captured fish immediately after observations have been made.

The flat-bottomed nets are successful for collecting large specimens. Have the child sweep the net back and forth among water plants and along the bottom of the stream or pond. Youngsters can also walk upstream for a distance with the net dragging behind them. The net is then pulled up and the contents transferred to a pail. Identify and record observations.

Have the youngster walk along the bank and look for any signs of animal life such as tracks and holes in the ground indicating a burrow. If the youngsters anticipate viewing large animals such as racoons, muskrats or turtles they may be disappointed. They will be very fortunate if they do.

PLANT LIFE

Have the child examine plants from several distinct areas. Look for vegetation that is growing on submerged rocks and logs. Find plants that are floating or drifting in the water. Several species of plants that are rooted in the bottom mud and

growing out of the water should be examined. Remind the youngster that plants may be pulled up with the roots but will have to be replanted. Observe the plants growing directly next to the water on shore, several metres away and then about 20 metres away. Identify and record.

Suggested Questions:

What differences are seen between plants?

How are the plants adapted to their particular area?

Are they all the same color? Do they all feel the same?

Do they look different when they are taken from the water?

Could the plants taken from the water live on land?

ADDITIONAL ACTIVITIES

1. Construct a closed ecosystem (instructions included at the end of this section.)
2. Draw, paint or construct a mural of the aquatic habitat.
3. Write a composition on a typical day in the life of a plant or animal that was observed in the stream.
4. Design a plant or animal that could exist in your stream.

POSSIBLE STREAM LIFE

Type of stream:	Bedrock	Rubble or gravel bottom	Sandy	Muddy or silt-bottomed
Characteristics:	provides little food and protection	-high stream velocity -carries ample supply of food and oxygen	-no solid rooting material for higher plants and no smooth surfaces for attachment of plants	-abundant rooting material -same characteristics as as pond
Plant Life:	blue-green algae perhaps some fountain moss	-blue-green algae -fountain moss -diatoms -water hypnum -elodea		-diatoms, algae -fountain mosses, hornwo -pickerel weed -water weed, burreed -arrowhead, watercress -duckweed
Animal Life:	-limited food supply therefore limited animal life -nematodes -mayfly nymph	-abundant -nematodes -bristleworm -planaria -larvae of: sponges bryozoans cranefly midge blackfly caddisfly riffle beetle -nymph of: mayfly, stonefly dragonfly, water strider, snails, clams, leeches, trout, minnows	-planaria -nematodes -mayflies -caddisflies -alderflies	-rotifers, copepods -protozoans, nematodes -tubifex, bristle-worm -bryozoans -nymphs of mayfly & dragon flies -caddis worms -midge larvae -amphipod, crayfish, -leech, water strider -water boatmen, snails -clams, sucker, -catfish, northern pike, - yellow perch

BUILDING THE EQUIPMENT

Materials

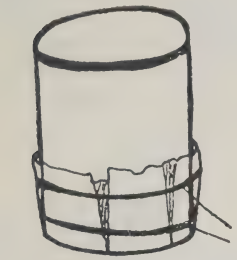
1. Plastic pails with handles (gallon size): Ice-cream, frozen fruit, or honey containers are also idea. One for each team.
2. Sorting trays: White or light colored dishpans are best choice, shallow aluminum foil baking dishes such as TV dinner containers or pie plates may be used. Aquatic organisms show up well against a white background so if aluminum containers are used, the bottoms should be painted white, or cut heavy white cardboard to fit inside the container. Several large sorting trays are needed for the instructor with each team possibly using a smaller tray.
3. Old spoons or hand trowels (optional): One for each team.
4. Waterscopes: May be made from heavy cardboard cylinders about half a metre in length. Mailing tubes, stove pipes, poster or paper containers are ideal. If cardboard cylinders are used they will need to be waterproofed with polyurethane or a plastic varnish. A bottomless bucket is also useful. Cellophane or clear plastic is needed to fit over one end of the tube. Instructions for use and assembly follow.
5. Microscopes (optional): Magnifying lenses are more practical for use in the field. Strings should be attached so the campers can hang them around their necks. One for each team.
6. Eye droppers and basters: Two sizes are preferable.
7. Collecting Nets: Hand dip and flat-bottomed nets. Although one net may be shared between several teams, one net per team is desirable. Nets may be made from coat hangers, nylon

stockings, cheesecloth, tape and wooden stakes such as broken hockey sticks or broom handles. Instructions for use and assembly follow. Plankton and seine (minnow) nets may also be used.

8. Bottom samples: For screening the bottom material an ideal collecting tool is a kitchen sieve or strainer. A hand-screen may be used which consists of a piece of screen tacked onto a wooden frame. Each team requires one sieve. Instructions for the use and assembly of the hand screen follow.
9. Containers: Small containers such as empty tin cans. One for each team.
10. Clipboards, paper, pencils: Clipboards of thin plywood or or heavy cardboard with paper and a pencil attached are needed for each team.
11. Field guides: A general identification key will benefit the youngsters while in the field. The Golden Nature Guides has a publication entitled Pond Life, which is ideal for identifying some of the more common life forms the children will find. As it may not be feasible for each team to have a guide such as this, suggestions on how they could prepare one of their own before the field trip follows.

Assembly Instructions

Waterscopes



Several coats of plastic varnish will be needed to waterproof cardboard cylinders, if they are used. When applying the varnish brush it up into the inside surface of the cylinder as far as you can reach with the brush. Cut the sheet of plastic so that when it is placed over the end of the tube it will extend 5-6 cm (1-2 inches) up the side. This can be kept tight and secure with elastic bands.

The waterscope may be used to look at the tiny animal and plant life on the stream bottom as it exists naturally. The pressure of the water causes the plastic to become a convex lens so that plants and animals appear larger than they really are.

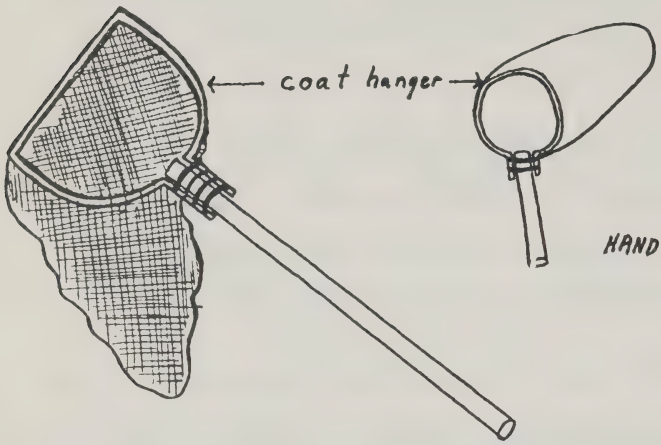
The success of viewing through the waterscope will depend on the brightness of the overhead sunlight and the clearness of the water.

Collecting Nets

Small hand dip nets are primarily used for collecting insects and other small aquatic life on the surface of the water, among plants, and under stones and logs along the shore. A circular frame is needed for attaching the net bag. Bend a coat hanger into a ring about 8 cm or 3 in. in diameter. Make a net bag from organdy, nylon stockings, or cheesecloth about 12 cm or 5 in. deep. Sew the bag onto the ring. Fasten the ring and bag to a stick or pole.

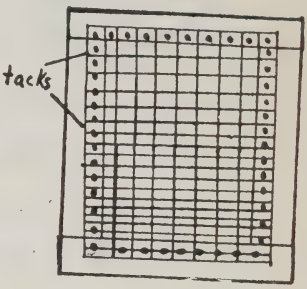
A flat-bottomed net is used to collect larger aquatic organisms throughout the water column. Bend the coat hanger wire into a

D-shaped frame about 35 cm or 14 in. in diameter. Make a net bag from cheesecloth, nylon stockings or netting of a 3 mm mesh, about 60 cm or 2 feet in depth. Sew the bag onto the frame. The frame and net bag can then be attached to a long pole of up to 90 cm in length with tape. A broom handle or hockey stick is ideal.



Flat Bottomed Net

HAND DIP NET



HAND SCREEN

Hand Screen

A frame can be built using pieces of wood about 30 cm or 12 in. in length. A mesh hardware screen of less than 1 mm. is tacked onto the frame. Bottom mud samples are then dug up and placed on top of the screen. Water is poured over it washing the finer particles through. Large stones should be removed by hand.

Identification Guides

Before entering the field illustrative drawings of the aquatic plants and animals should be made either on the blackboard or in poster form. Children need to be made aware of what they may

find and where to look. They could make up their own identification key and attach it to the clipboard. References such as the Ministry's educational fact shee on Aquatic Insects" which is included in this section, could be used.

SETTING UP A CLOSED AQUATIC ECOSYSTEM

At some stage during their lives, youngsters usually become intrigued with the idea of an aquarium. However, keeping it clean, feeding the fish and finding a sitter for a holiday period often becomes a burden.

How about setting up a closed ecosystem? It provides the same visual attraction as an aquarium; once established requires little or no maintenance; is relatively inexpensive; and, most importantly, can provide an exciting educational experience for children.

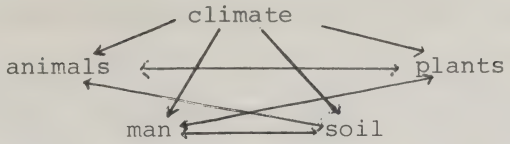
What is an ecosystem?

An ecosystem consists of groups of organisms (living creatures) together with their non-living or physical environment. All the components of an ecosystem - plants, animals, soil, water, air, light, wind and temperature - interact with each other for survival.

For example, plants provide food for some species of animals. In turn, these animals become food for other animals. The physical factors, like temperature, precipitation and soil determine the quantity and the quality of plants available.

Examples of ecosystems are lakes, ponds, forests, oceans and even the world itself.

In a diagram form, the ecosystem concept looks like this:



The closed ecosystem which we are discussing here is actually a picture of an aquatic community in miniature.

It consists of a glass jar filled with water, fish, snails and plants which are located in the bottom sediment. Once the lid is in position, it is like the earth. Apart from the sun's rays that supply life-giving energy for plant growth, nothing else is able to enter or leave the jar (or the earth) to sustain life.

How do the animals breathe?

By filling the jar only three-quarters full of water, the remaining quarter is left for air. The amount of oxygen in the air and water is constantly being replenished by the green plants, which give off oxygen during the day when they are manufacturing food for themselves. This food-making process is called photosynthesis and requires water, carbon dioxide and the presence of sunlight. (The carbon dioxide is provided by the plants themselves during the night and by the animals, who give off carbon dioxide when they breathe in the oxygen.)

The plants are also known as producers as they provide the animals with food (their leaves) and oxygen.

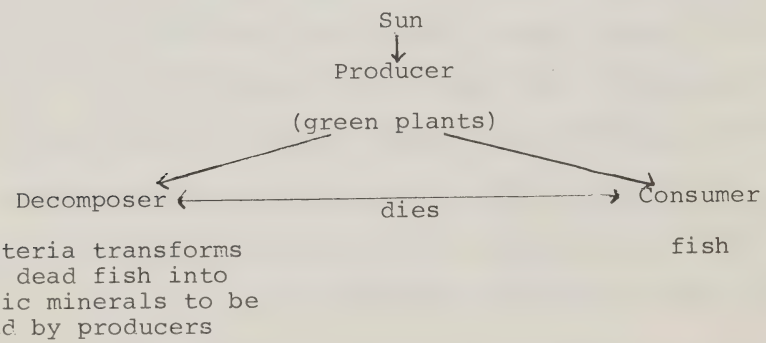
Will the animals ever starve?

If the system is a balanced one, the snails and fish should never go hungry. There should always be enough plants for them to eat. If however, their population should increase to such an extent that the available food supply is inadequate, the weaker members will die off until their numbers are in proportion to the food available.

The animals are called consumers because they use the oxygen produced by the plants and feed either directly on the green plants (this type of animal is called a herbivore) or on the animals that feed on the plants (these are the carnivores.)

Some animals play more than one role. The snails are consumers as well as decomposers.

Decomposers, such as snails, yeast, bacteria and fungi (most decomposers are microscopic creatures) work to break down the dead material and return it to the soil.



Does the water level in the bottle ever drop?

Over a 24-hour period, you may notice some very minor changes in

the water level. However, in a closed ecosystem, as on the earth, the water is always being recycled.

In the morning take a look at the sides of the jar, near the top. Do you see any water droplets? Check for the droplets again in the afternoon.

During the day, the heat of the sun raises the water temperature in the jar and some of the water changes to vapor and evaporates into the air - like steam from a bath. Overnight, when the vapor cools down, it condenses and turns back into water. In a natural setting, it would return as rain, or, if it is very cold, as ice.

This constant movement of water into the air and then back to the earth again is called the hydrologic cycle.

Construction of an Ecosystem

1. Obtain as large a bottle as possible (preferably one with a lid, or one that can be stoppered.)
2. Clean the bottle thoroughly.
3. Visit either a slow-flowing stream, or, preferably a pond or lake shore. A site where aquatic plants are growing will probably yield a variety of aquatic life, both plant and animal.
4. Scoop approximately two to three inches of bottom sediment into the bottle. If there are aquatic plants (especially algae) at the site, obtain a portion of these. (A kitchen sieve will act as a net to catch tiny aquatic organisms that might live amongst the aquatic plants.)

A. A Large Bottle
B. Aquatic Plants (Algae)
C. Bottom Sediments
D. Stopper or Lid
E. Rubber Gloves (Optional)
F. Kitchen Sieve
G. Plastic Bag and Guppies

5. Fill the bottle three-quarters full with water obtained at the site.
6. Return the bottle to the camp and place it on a window ledge (preferably a south-facing window) where sun will shine on it at some time in the day. Allow the contents to settle overnight.
7. If aquatic plants could not be obtained from the collection site, a visit to a local tropical fish store will be necessary Purchase a few strands of an aquatic plant such as Canada Water Weed (Elodea). If you haven't obtained some snails in your original sample then it might be wise to purchase some of them as well. If you want fish in your ecosystem, three or four small guppies might be purchased. (Remember, the guppies will eat some of the other life.)

8. Carefully insert the aquatic plants into the bottle and secure them in the bottom sediment (if necessary by tying them to a weight such as a stone).
9. If guppies are added to the system, they should first be placed in a plastic bag. The bag and contents should be placed in the ecosystem so that the water temperature in the bag has a chance to gradually become the same as the water in the ecosystem. This is necessary or the fish might suffer from temperature shock and die. After several hours release the fish from the bag into the larger container.
10. Place a lid on the bottle, but don't seal it.
11. After a few weeks, when the system is functioning and appears to be in some sort of balance, the bottle can be sealed by melting some paraffin wax and applying it around the lid or stopper so that no air can enter or leave.

Other Things To Consider

1. If time is not a factor, (and it shouldn't be) allow the system to adjust to the light source for several weeks before adding guppies.
2. If space and time is available, set up some experiments, using other bottles to illustrate various ecosystems. For example, you can add or subtract components of the system. More guppies can be added in a second bottle, or sediment might be excluded from a third bottle. Using the one ecosystem as a control, it is possible to see how each of the various components are important to the 'balance' that eventually is established.

1. May Flies (Ephemerotera)

May flies are abundant in streams and lakes and can be found in practically all fresh water throughout the state. The nymphs are found on the undersides of rocks or other underwater objects. They have two or three tails. The wings of the adult are held in an upright position while resting.

2. Dragonfly (Odonata)

They are found in all types of fresh-water areas; ponds, lakes, streams, and swampy areas. The nymphs can be found crawling about on the bottom, on aquatic plants, or other underwater objects. They are one of the largest aquatic insects; most of them are dark brown to greenish as juveniles, change to brighter colors as adults. When resting, their four wings are held outstretched.

3. Stone Fly (Plecoptera)

Stone flies seem to require running water in which to live. They are never found in lakes except in the inlets and outlets. When the adult is resting its wings lie lengthwise upon the back. Nymphs are found in abundance only among the rocks in streams. Stone fly nymphs have two long and stiff tails.

4. Water Boatman (Hemiptera)

Boatmen are found in nearly all waters. They swim in an erratic pattern underwater, and usually found in slow moving waters. Boatmen are normally brownish in color and equipped with leathery wings.

5. Water Strider (Hemiptera)

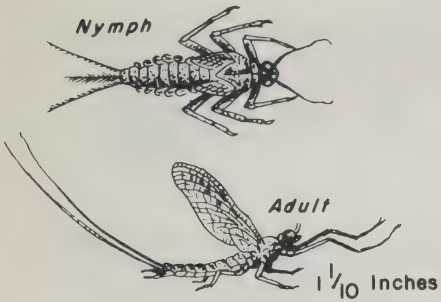
Water striders are a familiar sight on the surface of slow moving waters, ponds, and lakes. They resemble long legged spiders. Although equipped with wings, they are rarely observed in flight. Their color is usually brown to gray. Many persons call them "water skippers".

6. Caddis Fly (Trichoptera)

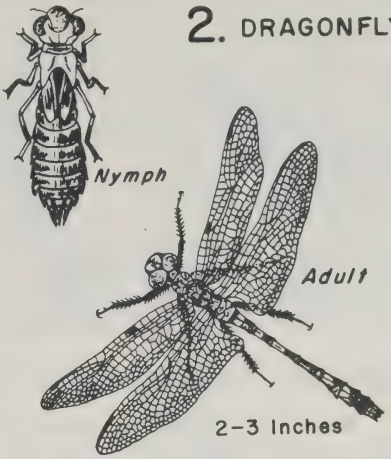
Caddis flies are found in nearly all lakes, streams, and ponds. During their underwater life, they live in cases made from sticks and small particles of rock. These can usually be seen moving about on the bottom. When the adults are at rest the wings are held roof-like over the body and sloping down at the sides. The adults are generally dull brown or black in color. Sometimes the larvae are called "penny winkles" by fishermen. "Periwinkle" is another common name.

AQUATIC INSECTS

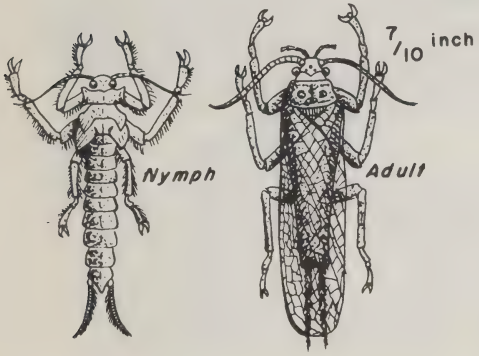
(REPRINTED WITH PERMISSION OF OREGON DEPARTMENT OF FISH AND WILDLIFE)



1. MAYFLY

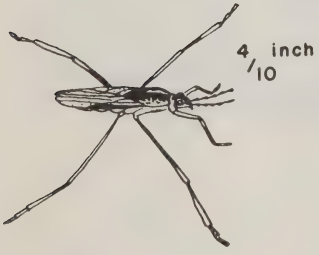


2. DRAGONFLY

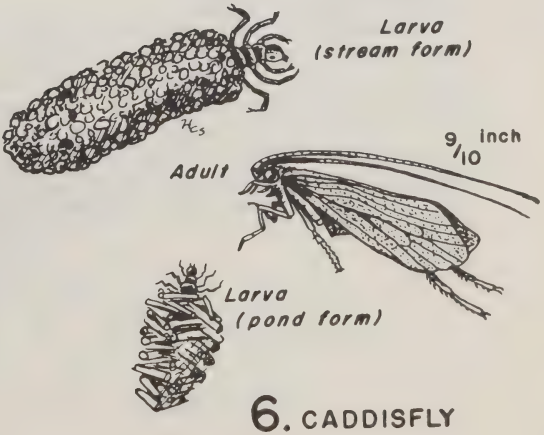


3. STONEFLY

4. WATER BOATMAN



5. WATER STRIDER



6. CADDISFLY

7. Whirligig Beetle (Coleoptera)

These are found on the surface of slow moving waters, taking advantage of the surface tension. The Whirligig beetles, true to their name, whirl or swim on the water's surface. When disturbed they dive under the water, frequently. Their bodies are dark colored, robust, and the front legs are long and slender.

8. Crane Fly (Diptera)

The larvae of the Crane fly are found in scum of shallow waters, in the damp soil along streams or lake shores, and marshy areas. The adults are never truly aquatic and may be found great distances from water. The adults look much like giant mosquitoes without a beak.

9. Mosquitoes (Diptera)

Mosquitoe larvae are usually found in stagnant slow moving water. Most people are familiar with the appearance of adults and know that they are more abundant around marshy, damp areas. The young are often called "wigglers" and can usually be found wiggling about just under the water's surface. Contrary to popular belief, not all mosquitoes bite, the males just buzz and are not equipped for biting.

10. Black Fly (Diptera)

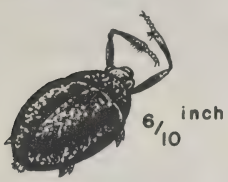
The larvae are found in flowing water (only) on stones, vegetation, or other objects, usually in the swiftest part of the stream. In many cases, the larvae are so numerous they appear moss-like over the surface of the attached object. Later on in life, they live in a cocoon which is customarily a boot-shaped structure. The Black fly as the name implies, are usually dark compactly built flies, with rounded black and short broad wings. The adults may be found great distances from water.

11. Midges (Diptera)

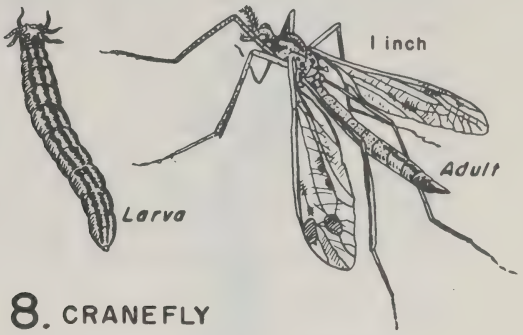
Larvae are most abundant in the shallow water areas of lakes, ponds, and streams favored by a heavy growth of aquatic plants. They prefer soft mucky bottoms, as they are a bottom-dwelling species, and need this type environment for constructing their tube-like homes. Larvae live in soft tubes, however, during later stages of life they are found living in silken cocoons or gelatinous cases. The adult Midges look much the same as mosquitoes. Their antennaes look like two feathers on the front of their head and they don't have a beak.

AQUATIC INSECTS

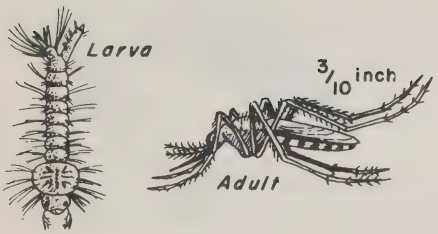
(REPRINTED WITH PERMISSION OF OREGON DEPARTMENT OF FISH AND WILDLIFE)



7. WHIRLIGIG BEETLE

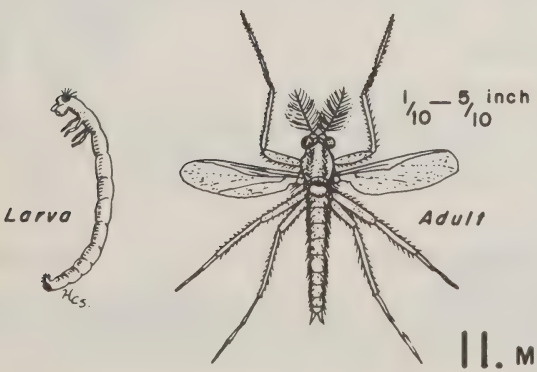


8. CRANEFLY



9. MOSQUITO

10. BLACK FLY



11. MIDGE

SURFACE FRESH-WATER ORGANISMS

1. Planaria (Turbellaria)

Planarians are fairly common in ponds, lakes, springs, and other fresh waters among vegetation, beneath stones, or crawling over the bottom. These free-living flatworms are usually arrow-shaped and vary in color from white to black depending on species and environment. Small planaria look much the same as the adult differing only in size.

2. Bryozoan Colony (Broyozoa)

Fresh-water Bryozoa are very common in lakes, ponds, and rivers. They are community dwellers, living in jelly type substance which is formed on sticks as a gelatinous ball or a mossy mat over the surface of underwater objects. There is a wide range in color, some colonies are brownish and still others have a greenish tinge. Colonies are made up of thousands of these tiny animals.

3. Leech (Hirudinea)

Leeches make homes in lakes, ponds, or other fresh-water areas. They can be seen moving about underwater by their well-known "Measuring Worm" type of travel, or swimming freely. Leeches are predatory or parasitic segmented worms with sucking discs which are used in attachment, movement, and feeding. They are usually dark brown to black in coloration.

4. Daphnia (Cladocera)

Daphnia are found in all sorts of fresh waters. The shallow, weedy backwaters of a lake whose water level is fairly permanent harbors greater numbers than any other kind of locality. These little crustaceans are virtually transparent, and are best recognized by their two-branched antennae, robust bodies, and sharp-tailed spine.

5. Cyclops (Copepoda)

These little fresh-water crustaceans are very familiar in all slow moving waters, especially shallow ponds. Their bodies, like the Daphnia, are very transparent and are characterized by the forked antenna and the branched tail. The female usually has two groups of eggs attached to her body just ahead of the tail.

6. Fairy Shrimps (Anostraca)

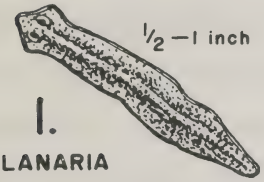
For the most part, fairy shrimps live in temporary pools and ponds of fresh water. They are frequently seen underwater, rowing themselves about on their backs, by means of numerous, similar, flattened appendages. These appendages are always faced toward the source of light.

7. Fresh-Water Shrimp (Malacostraca)

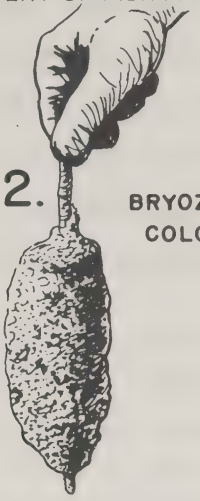
These are found in lakes, streams, and ponds in eastern and western Oregon. Shrimp are usually found among the aquatic plants, rocks, and algae. Usually they are nearly transparent and look something like a "sow bug".

SUB-SURFACE
FRESH WATER ORGANISMS

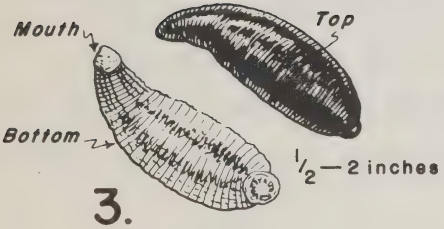
(REPRINTED WITH PERMISSION OF OREGON DEPARTMENT OF FISH AND WILDLIFE)



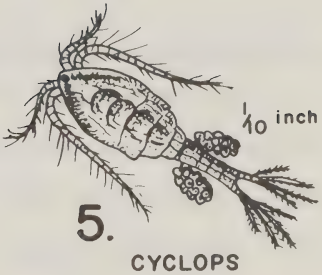
1.
PLANARIA



2. BRYOZOAN COLONY



3.
LEECH

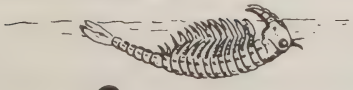


5.
CYCLOPS

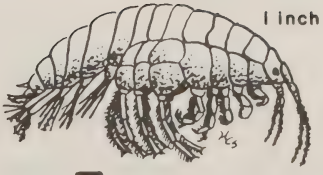
DAPHNIA

4.

FAIRY SHRIMP 1 inch



6.



7. FRESH WATER SHRIMP

ADAPTATIONS

For the Mentally Retarded:

We have found that this activity was highly successful with mentally retarded youngsters as long as the instructor did not attempt to undertake too many of the activities at one session. For example, half an hour spent one day looking for aquatic insects proved more than sufficient. It is important also not to overwhelm the children by introducing too many different types of equipment.

The ecosystem concept is explained more easily if pictures for climate (sun, clouds, rain), animals, man, soil and plants are used instead of just the words.

The youngsters find the life cycles of frogs and mosquitoes very interesting, especially if they can watch a tadpole grow into a frog.

For the Physically Handicapped:

Try to undertake visits to sewage treatment plants, reservoirs and water treatment plants. If possible, push their chairs into a shallow stream and let them observe nature first hand. Obviously, the nets must have longer handles than usual.

For the Deaf:

See the Air Section for suggestions on water experiments for the young deaf child.

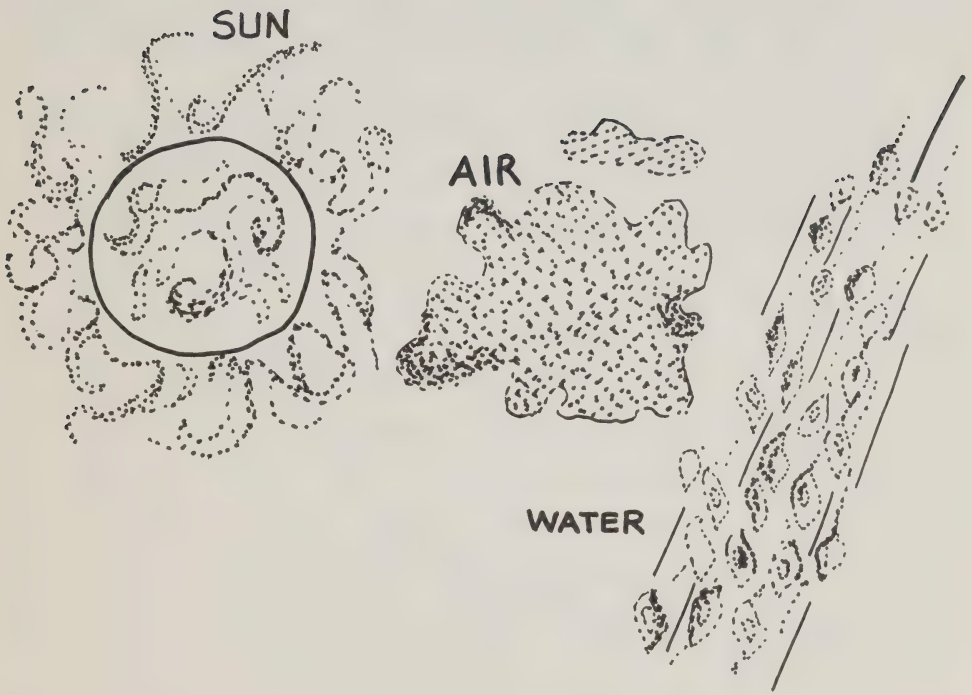
Nine-to-twelve-year old deaf youngsters can learn to sharpen their observational and question seeking skills through involvement in long term activities. Visits to a stream should be made several

times over the year to see and investigate changes. Observing tadpoles change into frogs is also a good learning experience.*

*Note: Tadpole Farming

1. Let the water stand for a week in a plant-filled aquarium.
2. Get the tadpoles from ponds or creeks in the early spring. You should get roughly four tadpoles for every 250 milliliters of water in your tank.
3. When the tadpoles have been in the tank for a week begin to change the water daily.
4. Feed the tadpoles small amounts of dried cat food or large amounts of fresh water algae.

Weather



WEATHER

Weather is determined by the air around us. If the air is cold and dry, the weather will be clear and sunny. If the air is warm and humid, the weather will be cloudy and perhaps showery.

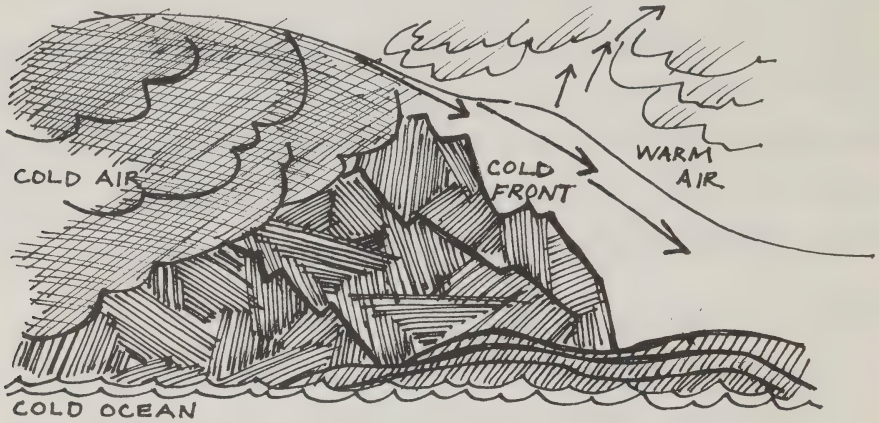
All of the changes and movements in the air which make up the weather take place in the troposphere - the bottom layer of the atmosphere closest to the earth. The air here moves in great masses that move at a variety of speeds. There can be as many as fifty air masses covering the earth at any given time.

There are four basic types of air masses:

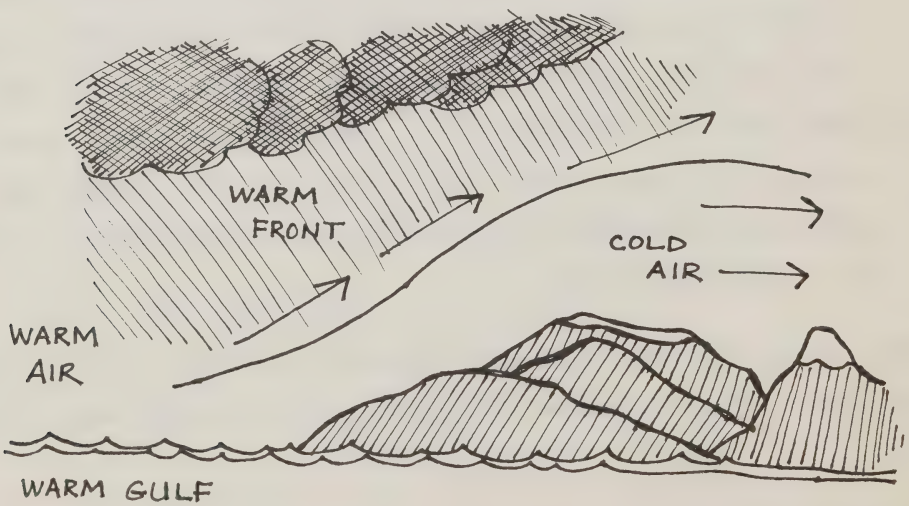
1. Cold, dry air masses that form over cold land areas. They bring clear, dry weather, few clouds, light winds and excellent visibility.
2. Warm, humid air masses that form over a warm body of water. They carry clouds and rain showers.
3. Cold humid air masses that form over a cold ocean. When the air mass passes over mountains, it often drops its moisture -- rain in summer, snow in winter. These air masses are welcome in summer because they bring relief after a hot spell.
4. Warm, dry air that comes from a tropical land area. These air masses bring clear skies with no moisture and extreme temperature differences in day and night. These extremes lead to strong gusty winds.

When a cold air mass moves into an area, it usually slides under the warm air that is there already forcing it up and away. (Cold

air is heavier than warm area.) The forward surface of the cold air mass is called a cold front. It often means stormy weather with rain, strong winds and perhaps thunder and lightening.



A warm front is the forward surface of a warm air mass. When it enters an area it usually slides over top of the cold air and eventually pushes the cold air out. There are usually clouds and a steady snow or rainfall or showers with a warm front.



The weatherman forecasts or predicts the weather by determining which air masses and fronts will be shaping the weather in his area. He bases his forecasts on such things as the air pressure; temperature and humidity of the air; the direction and speed of the wind; the percentage of the sky covered by clouds; and, the amount of any rain or snow that falls.

Activities

You, too, can learn to predict the weather. Here are a few pieces of equipment, which you can make to help your forecasts be as accurate as possible.

First of all, build a weather hut or shelter for your equipment. Place a large wooden or cardboard box on some sort of stand. Make sure that it is about four feet above ground level and away from any building or wall. Set the box so that one side can be opened and closed; this side should face north. Poke a few holes in each of the sides so that air can circulate through the shelter.

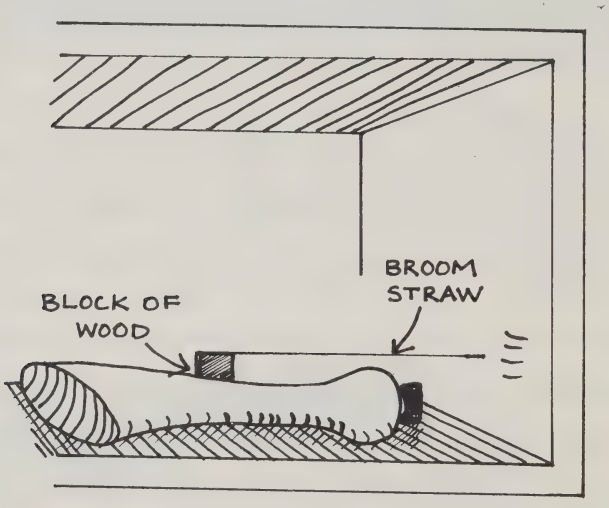
A. A barometer is used for finding out the air pressure. When the barometer goes up, fair weather is ahead. When it goes down, poor weather is approaching. It is not the exact reading that counts, but whether it is rising or falling.

Equipment: clear plastic detergent bottle with cap
glue
small block of wood
broom straw

1. Smear glue around the mouth of the bottle. Squeeze as much air as possible out of the bottle to make a partial vacuum inside. Screw the cap tightly over the glue to seal it. Changes

in the air pressure now will make the bottle expand and contract.

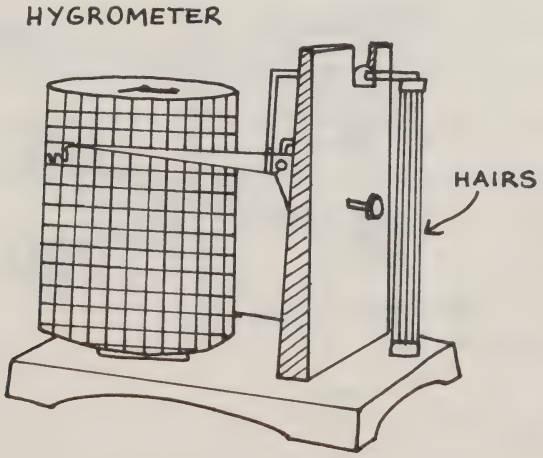
2. Glue a small block of wood to the middle of the side of the bottle. Glue a broom straw horizontally onto the wood. The straw is the pointer of the barometer.
3. Place the barometer on its side in the shelter, with the end of the straw pointing to one side of the box.
4. Listen to a weather report on the radio and mark down the official air pressure at the level your straw now points to. Repeat once a day for a week. By that time you will have several points to use as a scale of air pressure.



B. A hygrometer is used to tell the humidity in the air. There are several methods. One of them is using a long human hair. The hair picks up humidity - it lengthens when the humidity is high and shortens when it is low.

Equipment: square of heavy cardboard 12" wide by 12" long
single strand of hair 10" long
a pointer of thin cardboard 6" long
pencil

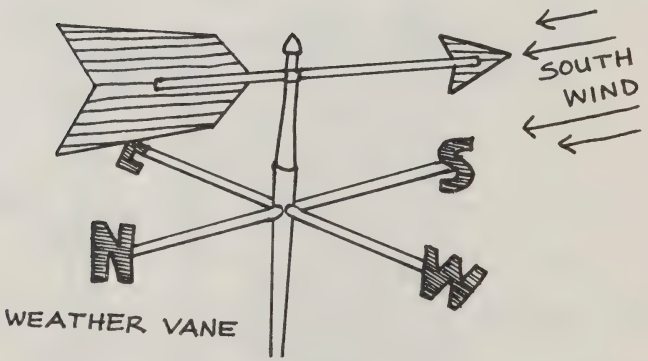
1. Use a pencil to poke two small holes, one above the other in the blunt end of the pointer.
2. Carefully tie one end of the hair through the lower hole.
3. Push a thumbtack through the other hole to attach the pointer loosely to the cardboard near the top.
4. Push another thumbtack into the cardboard about 6" below the hole through which the hair is tied.
5. Pull down on the hair until the point is straight from side to side. Tie the loose end of the hair to the bottom thumbtack.
6. Stand the hygrometer in the shelter against one wall. Find out the humidity from the radio and mark the percentage on the cardboard where the pointer is pointing. Each day for a week put a mark where the pointer points, so that you have a humidity scale. (The greater the humidity, the lower the pointer.)



C. A weather vane gives you the direction of the wind.

Equipment:
- wooden board (roughly 5" by 8")
- 2 nails (one headless)
- compass
- aluminum pie plate
- scissors
- plastic straw

1. Hammer the headless nail into the centre of the board so that approximately 1½" is sticking up.
2. Use the compass to mark the four directions, north, west, south, and east along the four edges of the board.
3. Use scissors to cut a 2" wide strip from the flat centre part of the pie plate. Shape one end into a point. With two staples, staple the centre of the strip to one end of the plastic straw. Place the straw over the nail in the board.
4. Mount the entire structure on top of your shelter. Be sure that the side of the base marked north is facing in that direction.

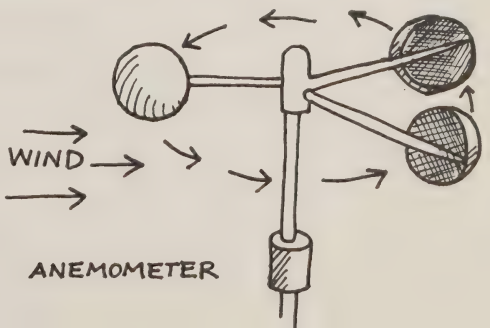


WEATHER VANE

D. An anemometer or wind speed indicator is used to calculate the wind.

Equipment:
- headless nail
- wooden board (roughly 8" x 5")
- plastic straw
- 3 light plastic cups
- aluminum pie plate
- nail with a head
- staples and stapler

1. Hammer the nail into the center of the board. Let at least 1½" of nail stick up.
2. Place straw over the nail.
3. Staple cups to the edge of the pie plate. They should be on their sides along the edge, at equal distances apart and all facing the same way.
4. Balance the plate on the straw and push a nail with a head through the plate and into the open top of the straw.
5. Before mounting the anemometer on the shelter, calibrate the instrument. On a windless day, ask someone to take you and a friend on a short drive. When it is safe to do so, drive at exactly 5 miles an hour and then hold the anemometer out the window. At the same time, have your friend look at a watch and time exactly one minute. Count the number of times the anemometer turns during the minute. Repeat procedure at 10 and 15 miles an hour and write down your results.
6. You will then have a scale for measuring wind speed by counting the number of turns of the anemometer. Mount the instrument on the shelter.



ANEMOMETER

E. A precipitation gauge helps to measure the amount of fallen rain or snowfall.

Equipment: empty one pound coffee tin
ruler

1. Place the empty tin can on top of the instrument shelter.
2. After it rains or snows, insert ruler into the can and measure the depth of water.
3. Each inch of water in the can indicates about one inch of fallen rain.

F. A thermometer gives you the temperature of the air. Although it is possible to make a thermometer, this is one item that you should buy. Put the thermometer in your weather shelter.

G. Clouds can also give you an indication of the type of weather to expect. For example, some tell of fair weather (these are called altocumulus) and others of violent storms (cumulonimbus).

There are several ways of classifying clouds. These can be classified by altitude into four families: - high clouds
- middle clouds
- low clouds
- towering clouds;

or into shapes - cirrus - featherlike
- stratus - in a layer
- cumulus - in heaps
- nimbus - a scraggly cloud from which rain falls

These terms are often combined to make the description more exact. The word, alto, high may be put in front to indicate a cloud of high altitude. See cloud chart on following page.

H. A weather chart will help you with your weather observations. Try to make daily observations of weather conditions at the same hour each day.

To make the chart, use a large piece of paper marked with the following headings:

WEATHER CHART

Date & Hour	Clouds	Temp.	Air Pressure	Humidity	Wind Speed	Wind Direction

CLOUD CHART

Cloud Name	What are the clouds made of?	What may fall from the clouds?	What weather do the clouds forecast?	How high?
Cirrus	ice crystals	nothing	fair, but rain or snow, if clouds thicken	4 miles or more
Cirrostratus	ice crystals	nothing	fair if they break up into cirrocumulus	4 miles or more
Cirrocumulus	ice crystals	nothing	rain if clouds thicken and lower	4 miles or more
Altocumulus	drops of water	light rain or snow	rain if corona around sun or moon decreases	1 to 4 miles
Altostratus	ice and water	steady rain or snow	storm if clouds darken toward the west	1 to 4 miles
Stratocumulus	drops of water	drizzle or snow flurries	changing weather	¼ to 1 mile
Stratus	drops of water	drizzle or snow flurries	fair weather if clouds get smaller	0 to 1 mile
Nimbostratus	ice and water	steady rain or snow	long rainy stretch	0 to 1 mile
Cumulus	drops of water	nothing	generally fair	¼ to 4 miles
Cumulonimbus	ice and water	heavy rain, snow or hail	thunderstorms	¼ to 4 miles

WEATHER CLUE CHART

Look for	When					
	Clouds	Humidity	Pressure	Temp.	Visibility	Winds
Weather to stay FAIR	move higher and decrease in numbers when morning fog disappears	stays low	remains steady or goes up slowly	Is what is expected for the season	stays good	are west to northwest and gentle
Weather to get WORSE	Thicken, lower and darken to the west	goes up	falls steadily or rapidly	Is too high or low for the season	decreases	shift to between east and south
Rain or Snow	Change from cirrus to lower types of rain or snow clouds	goes up	falls - the faster, the sooner rain or snow	goes up	decreases	increase in speed usually from the east
Thunderstorms	Change from cumulus to cumulonimbus	--	falls	--	--	increase in speed rapidly
Weather to CLEAR	Rise and break up	goes down	rises	rises after warm front drops after cold front	increases	swing from east through south to west
Colder Weather	--	--	rises	goes down	--	from north or northwest
Warmer Weather	--	--	falls	goes up	--	from the south

ADAPTATIONS

For the Mentally Handicapped:

Keeping a chart of daily temperatures is a good learning experience for these youngsters. The children listen to the radio each day for the weather forecast and color in the square marked with the appropriate temperature reading.

Pictures of cloud types are good attention getters. Stencils can be cut out of cardboard for tracing or the cut out pieces can be placed on paper, painted around and then removed, leaving white clouds.

For the "Special" Child:

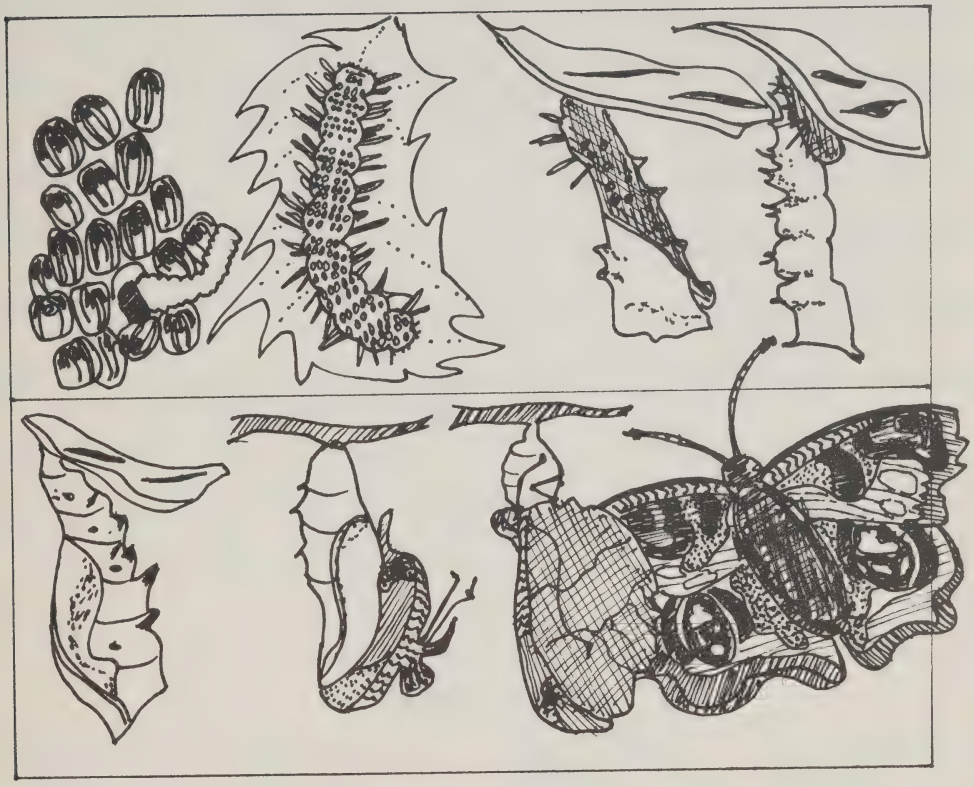
Kite flying, preparing own kites, choosing materials, giving demonstrations of flying techniques, etc. can be combined with information on wind and wind currents.

For the Deaf:

Building and operating equipment for a weather station has proved a very successful learning experience for the older, deaf child.

Weather forecasting, using information on wind direction, barometric pressure and cloud formations, should be attempted. Keep logs on the results. Graphs could also be made to show temperature changes, precipitation and barometric pressure.

Arts & Crafts



CRAFT IDEAS USING NATURAL MATERIALS

MATERIALS	PROCESS	USE
driftwood	leave in natural state or rub it down with oil or wax	decoration, jewellery. mobiles, totem poles
twigs & branches	whittling and carving	furniture, birdhouses, whisk, brooms, spoons, forks, nametags, pins
bark	soak in hot water to make it pliable	bookmarks, hatbands, pocketbooks, whistles
nuts	clean with wire brush, sandpaper and wax, oil or shellac	bracelets, brooches earrings, label pixies
pine needles		brooms, pillows
pine cones		animals, mobiles, birdfeeders, dolls, collages
berries		use juice for dyeing or staining
fungi	dry and then shellac to preserve	name plaques, shelves
mosses		pictures
seeds		bean bags, jewellery, rhythm instruments, collages, signs
sand		painting

DYEING

raspberries	dark red	onion skins	red or yellow
strawberries	red	bark	brown
goldenrod	yellow	dandelion roots	magenta
blackberries	blue	moss	light green

To prepare dye:

Cut the dye ingredient into small pieces and pound. Place ingredient in pot and cover with 7 cm of water. (The more water you use, the lighter the color will become). Boil for one hour. Strain fluid.

To dye cloth:

Place dye in pot and add material (Dye solution should cover material) Boil for one hour. Add two tblsp. salt. Boil another 15 minutes. Remove cloth from dye and rinse in cold water. Hang out to dry.

A PLANT PRESS

Take two sheets of hardboard or plywood about 45 cm x 30 cm (or 1½ ft x 1 ft) and drill a few holes in the board to allow evaporation. Tie an old belt or strap around the boards to apply pressure.

Put some sheets of newspaper on the lower half of the press and cover with one or two sheets of blotting or other clean absorbent paper.

Arrange specimens as naturally as possible on this paper. Turn the leaves so that you see the upper surface of one and the lower surface of another. Textures are often important for identification.

Cover with one or two sheets of absorbent paper. Add more newspaper. Replace the top of the press and tighten with the strap.

Leave in a warm room for a few days and then open up and replace paper, if necessary.

It usually takes about three weeks for the plant to dry, depending on the amount of moisture it contains.

Put the specimen in your collection. A loose-leaf folder makes a good storage place. Attach the specimens to the paper with small pieces of gummed paper.

Pressing flowers always distorts their shape. If you want to preserve them in their true form you can try drying them in a sand or borax bath (see "Arts and Crafts" section). They will lose most of their color but will retain much of their detail.

A CRYSTAL GARDEN

You may not be able to work in your garden outside once winter comes but here is an exciting way to enjoy a beautiful indoor garden after the first snowfall.

Equipment:

- lump of coal (or broken brick, porous rock or synthetic sponge)
- water
- glass container or bowl
- 4 tblsp. water
- 4 tblsp. liquid blueing
- 4 tblsp. household ammonia
- 4 tblsp. salt

Method:

1. Soak coal in water until thoroughly wet. (If using a sponge wring it out). Place coal in bowl.

2. Combine 4 tblsp. of water, blueing, ammonia and pour over coal, wetting entire area.

3. Sprinkle on salt.

Within a few hours, delicate crystals will begin to form, making unusual shapes. Your garden will last about two days. If you wish it to continue growing, add 2 tblsp. of water and 2 tblsp. of ammonia to the bowl very two days.

You can also add twigs, food coloring, and small rocks to your garden.

When you are finished working in your garden, place a glass bowl over the top to keep your creation from drying out and crumbling.

Note: Do not let crystals form over rim of the bowl as they can damage the finish on furniture.

WAKE-UP GARDEN

Ever wonder how many living things are spending the winter under ground. Find out by making a wake-up garden.

Equipment: After a winter thaw, dig up some soil from the top of the ground, about 0.092 m (one square foot) and 5 cm (2 in.) deep. Place the soil in a terrarium.

Terrarium: Two pieces of window glass 25 cm x 20 cm (10 in. x 8 in for the ends;two pieces 25 cm x 40 cm (10 in. x 15 in.) for the sides; and one piece 43 cm x 22 cm (17 in. x 9 in.) for the top. Tape the ends and sides together to make a glass rectangle. Shellac the taped cones to make them waterproof.

Spread freshly mixed plaster of paris over the bottom of a shallow pan measuring about 43 cm x 22 cm x 2 cm (17 in. x 9 in. x 1 in.) high. Set the terrarium into the pan and press it down firmly into the plaster. Allow the plaster to harden.

Put the soil into the terrarium. Place glass cover on top and set in good light. As the soil warms up, lots of little creatures that have been spending the winter underground will begin to move about. You'll also see many little plants sprouting up from seeds that have been buried in the soil.

Empty the "garden" on some large sheets of newspaper and see how many little plants and animals you can count that were living in this 0.092 m (one square foot) of soil.

Accitional Activity:

Use your terrarium to raise a miniature orchard. Wash thoroughly. Cover the bottom with clean gravel or bits of broken flower parts to provide good drainage.

Spread 7 cm (3in.) layer of well-sifted sandy garden soil with some leaf mold added. Plant seeds in rows from your breakfast oranges, grapefruit, lemons, and apples. Try acorns.

CONSTRUCTION OF A TERRARIUM

Terrariums have brought joy to people for nearly one hundred years, ever since a Dr. Ward of England, noted that plants kept growing under tightly sealed glass. Have you considered why plants are able to grow in the sealed container? Why light is required by plants? Why an animal can remain alive in a terrarium but quickly suffocates in an empty sealed container? The terrarium you construct is a model of a terrestrial ecosystem, enabling you and your child to witness the interactions that occur between plants, animals, and the non-living environment to maintain a balance between themselves. Your child will come to realize, by observing this closed environment, that things constantly change. (For a more detailed explanation of an ecosystem see "Setting Up A Closed Aquatic Ecosystem").

BUILDING THE TERRARIUM*:

You and your child can make a terrarium in anything from a baby food jar to an aquarium (even a leaky one). The principles are the same. The materials you need are:

1. A container that light rays can penetrate
2. Gravel or sand
3. Charcoal
4. Soil with some humus (decayed plant material)
5. Small plants and tree seedlings (dig up soil with the roots). Mosses, ferns, violets are fine. Keep in a plastic bag until ready for use.
6. Small saucer of water
7. A pretty rock or two
8. Plastic wrap or glass to cover the terrarium
9. A few grass seeds
10. A small thermometer to keep in a corner of the terrarium
11. Animals: a snail or slug, bugs, beetles, frog, toad, ant, grasshopper, snake, or caterpillars

Putting it Together:

1. First, put in a one- to two- inch layer of gravel for the excess water to drain down into.

2. Then add small pieces of charcoal to the soil. Charcoal is burned wood with lots of air spaces and its addition will keep the soil well aerated and will absorb gases. To use commercial charcoal briquets effectively, break them into small pieces to increase aeration. Better yet, if the briquets are burned, the alkalinity or "sweetness" of the soil increases. For greater effectiveness, add burned wood ashes. This will improve both the physical and chemical structure of the soil.

   (An alkaline or "sweet" soil contains more elements of calcium, potassium, and some compounds such as lime. Some plants thrive better in "sweet" rather than in "sour" soil.)

3. Add two to three inches of topsoil. Don't use playground clay, but soil from under bushes, along fences, or in other areas where some humus has accumulated.

4. Add a small water dish to serve as a pond for animals to drink from and to supply a good humid environment.

5. Add the plants. Space the plants to allow room for growth. You may also want the children to plant a few seeds or nuts.

6. Add the animals. Do not put large animals in -- no mammals. A snake or toad needs room; snails, worms and ants need less room.

7. Place the terrarium near a window but do not let the sun shine directly on the terrarium or you will have an oven instead of a terrarium. Do not set the terrarium on a radiator or other heat sources.

MAINTENANCE:

If the terrarium seems dry and a "rain" doesn't fall from the top of the container, sprinkle a little more water in. If mold is forming, it is too wet. Leave the top off for a day, or leave a slight space in the top covering. Dead plants or animals should be left to illustrate the recycling of material.

The children may respond with a request for more animals than the terrarium can handle. Keep the number and size of the animals limited. Too many slugs can defoliate your terrarium and a medium-sized turtle can trample it. You may have to be selective.

The terrarium can self-support a limited supply of plant-eating animals, and probably only one meat-eating animal. For instance, several grasshoppers will eat the plants and, in turn, be the food for a single toad.

The purpose of limiting the supply of animals to a closed terrarium is to demonstrate how soil, plants and animals, thriving within the confines of the container, depend upon the life and death of each other. The terrarium plants and animals may exist totally independent of any outside forces. This is representative of a closed system. The mini-world in your terrarium is self-supporting.

ADDITIONAL ACTIVITIES

1. To demonstrate the importance of sunlight to plants place one plant in a dark cupboard while leaving a second plant in the light. Observe the changes in the plants' appearance daily. The plant in the dark will wilt, lose color, and eventually die because it cannot produce food without light.

2. Construct a food chain mobile using the plants and animals in your terrarium. Start with the word "sunlight" at the top of your chain. What other things do plants need to grow so they may feed the animals?

3. Over a period of time, many changes occur in the terrarium. Each day the terrarium's physical environment changes; in addition, all of the living things in the terrarium undergo change. The child should look for changes and record them.

   Types of changes you might look for:

   Plants: seeds sprouting, seedlings growing, flowers developing, fruits, plants decaying, mold forming

   Animals: reproducing, dying, moving, shedding skin

   Other: temperature changes, water recycling-evaporation of the water as the temperature rises in the afternoon and condensation occurring overnight on the sides of the jar as a result of cooler temperatures

4. Compare changes in the backyard to changes in the terrarium.

*"Building the Terrarium" section is reprinted with permission of the Ohio Department of Education and the Willoughby-Eastlake School District.

Mobiles

Create mobiles by cutting out different nature photos from magazines or by drawing pictures yourself. Paste them onto cardboard. Using different lengths of string, tie them to pieces of wire or a coat hanger. Can also be used to depict food chain and web.

Spore Printing

Spore plants, such as mushrooms and toadstools, multiply themselves by shedding a fine powder made up of particles called spores. These spores produce the new plant.

Place the head of a toadstool or mushroom, underside down, on a white sheet of paper and keep it in a dry place overnight. In the morning you will find that spores will have fallen on the paper and formed a pattern called a spore print.

Alternative: Apply a thin coat of a half-mucilage-half-water mixture (or a slightly beaten egg white) to a sheet of thin cardboard. Leave the mushroom, underside down, on it overnight.

Leaf Prints

Pin pressed leaves or ferns on drawing paper. Spatter paint on paper by scraping a toothbrush dipped in paint or ink across a screen. Remove leaves when ink is completely dry.

Alternative: Apply ink to back of dried leaf with a roller. Carefully press a sheet of paper over inked leaf.

Alternative: Lay leaf, vein side down, in ink pad. Cover with fresh scrap of paper, rub hard. Transfer leaf, ink side down, to white paper. Cover with fresh scrap of paper. Rub hard being careful not to move leaf.

Sand Casting

Put sand in a box large enough to hold object which is to be cast plus a border along all sides. Dampen sand so the grains will stick together. Draw or carve design in sand or sink object to be moulded. In a separate container, stir equal amounts of water

and plaster of paris until mixture thickens. Pour plaster into depression, filling deepest areas first. If you are making a plaque, place a twisted wire in the back to make a wall hanger. Remove plaster when hardened (approximately 1 hour). Some sand will stick to the plaster. It may be left for texture or may be removed with a brush. Design may be painted.

Rubbings

Cover leaf, fern, bark, twig, etc. with a thin piece of paper. Hold the paper with one hand, and with the other, rub a crayon gently over the paper. When you have finished you will have a detailed print of your piece of nature.

Sun Prints

Pin one or more leaves to a piece of colored construction paper, and put the paper in bright sunshine. After an hour or so, remove the leaves and you will have their outlines.

Soil Painting

Collect various types and colors of soil. Now sketch a picture on a piece of cardboard and apply glue where you want one type of soil. Sprinkle on soil. Brush glue on another area of picture, not too close to the already drying area, and add new soil. Continue until scene is complete. When soil is completely dried, stand the picture on a side and the loose particles will fall off.

Alternative: Mix soil with plaster of paris and apply immediately. Soil will dry lighter than it goes on.

Table Mats

Place several leaves and colored threads or small ferns between two sheets of wax paper. Press with a warm iron to seal paper together. Use scissors to scallop edges.

Plaster Casting of Bark

Squeeze and roll a half pound of plasticene until it is soft and flexible. Apply it to the bark area that you want to record. Work the plasticene thoroughly into the cracks and crevices. Carefully peel plasticene from bark so that it remains whole. Coat with vaseline.

Make a collar out of two-inch high cardboard and place it around plasticene mould.

Mix plaster of paris with water until mixture is the thickness of glue and has no solid lumps. Before it hardens, pour plaster of paris into the mould. Tap sides of collar to allow air bubbles to rise to surface. Insert paper clip so that cast can be hung on wall when it is dry.

When cast is hard, remove collar and mould; clean vaseline from impression.

To make cast even harder, boil it for a few minutes in a solution of one tblsp. borax to one pint water.

Try to paint your cast the same color shades as your tree (tempera paint is ideal).

Layered Transparencies

To decorate greeting cards, booklets, etc. Find leaves, feathers, grasses, ferns, etc. (Some may need to be pressed flat). Lay specimen or arrangement on waxed paper. Cover with a single layer of facial tissue (separate it) or rice paper. Mix white glue with water, half and half. Use stiff brush to go over surface and evenly saturate tissue with glue. Allow to dry. Iron between brown paper at "silk" setting. Trim with scissors.

Making a Plaster Cast for Animal Tracks

Equipment: Strips of cardboard 25 cm in length, 5 cm wide; paperclips; water; plaster; mixing can and spoon.

Carefully clean the area around the track of debris. Form a circle around the track with the cardboard and fasten it together with a paperclip. Press the ring into the soil for support. Mix the plaster according to instructions on bag or can. Pour plaster into the ring until print is covered. As plaster settles insert a paperclip along ring at the top of print for a hanger. Tap the edge of the cardboard gently to remove bubbles. Allow mold to set, then carefully lift up and remove cardboard.

A Snow Cast

Spray the track with a fine mist of water to build up a layer of ice in the track. When mixing plaster, add some snow to lower the temperature of the plaster to avoid melting print.

Preserving Specimens

To preserve colored autumn leaves or flower blossoms or other plant specimens for a collection or a dried bouquet, try one of these methods:

a) Sand Box

Collect leaves, flowers, etc. Remove leaves from flower stems. Put some sand in the bottom of a box. Make layers with specimens and sand. Put the box in a very warm, dry spot for a week.

b) Borax

Put layer of borax crystals in a shoe box. Layer specimens and borax so that samples do not touch. Cover so none stick out. Put lid on box and put away for a few weeks. A plastic bag around the box will keep out moist air. Allow three weeks for leaves and four weeks for flowers.

c) Plant Press

Wall Hangings

a) Burlap

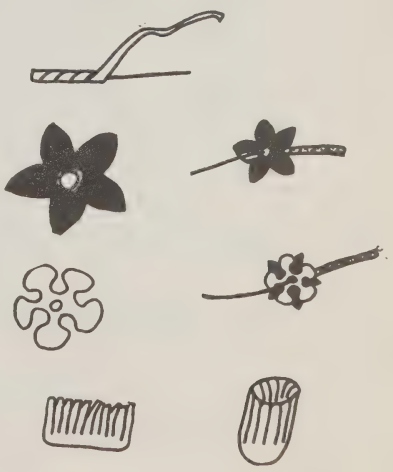
Pull out cross strands and weave in materials of your own choice -- vines, feathers, moss, bark, etc. Glue, tack, or staple ends to a branch or stick. Attach cord for hanging. Fringe sides.

b) Plaque

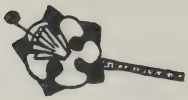
Glue or sew grasses, flowers, seeds, bark, pine cones, shells, or any other natural items on burlap or on a board for a plaque.

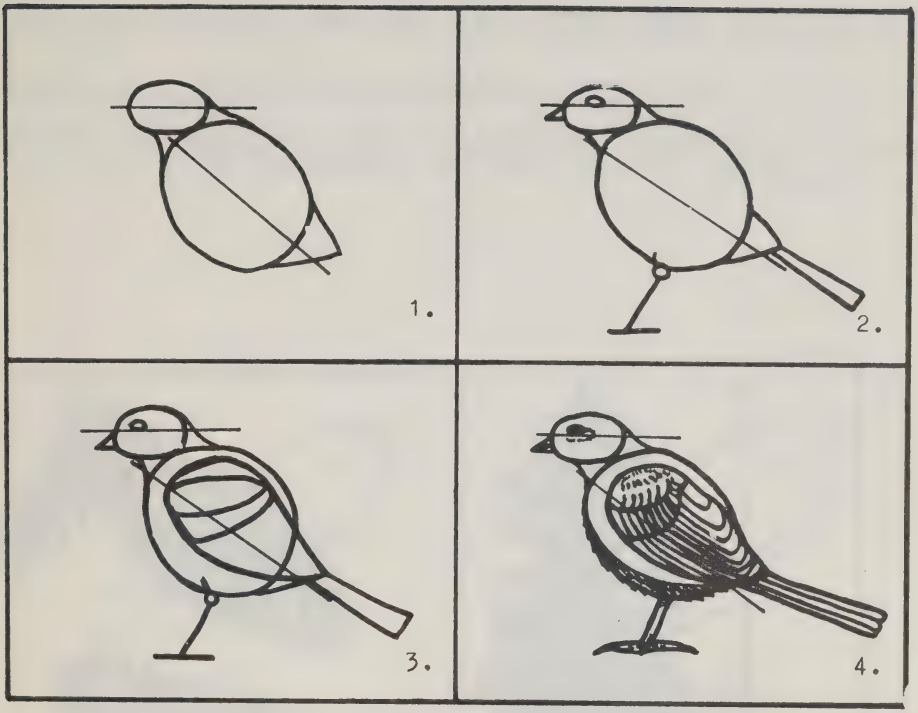
Maxi-Flower Models (see flower diagram - Lawn Study)

1. Wind some green florists tape around a length of wire. Coat hanger wire will do.
2. Cut a whorl of sepals. Look to see how many points you should have. These are usually green, but not always. Thread on your wire.
3. Cut out a whorl of petals. There may be more than one. Choose the correct color or colors. Thread this onto your wire also.
4. Find out how the stamens grow in your plant. How many are there? Cut a strip of material into a fringe, with the correct number of stamens. Wrap this around the wire. Spread the stamens as they should be.



5. Examine the pistil of your plant. How long is it? Does it divide? Has it a knob on the tip?





Drawing a Bird

1. Draw the basic body shapes -- an oval for the head, a larger one for the body, and a tail shape.

2. Add the eye, beak, leg/foot (indicating the leg joint) and the tail feathers.

3. Sketch in the main shapes of the wing feathers.

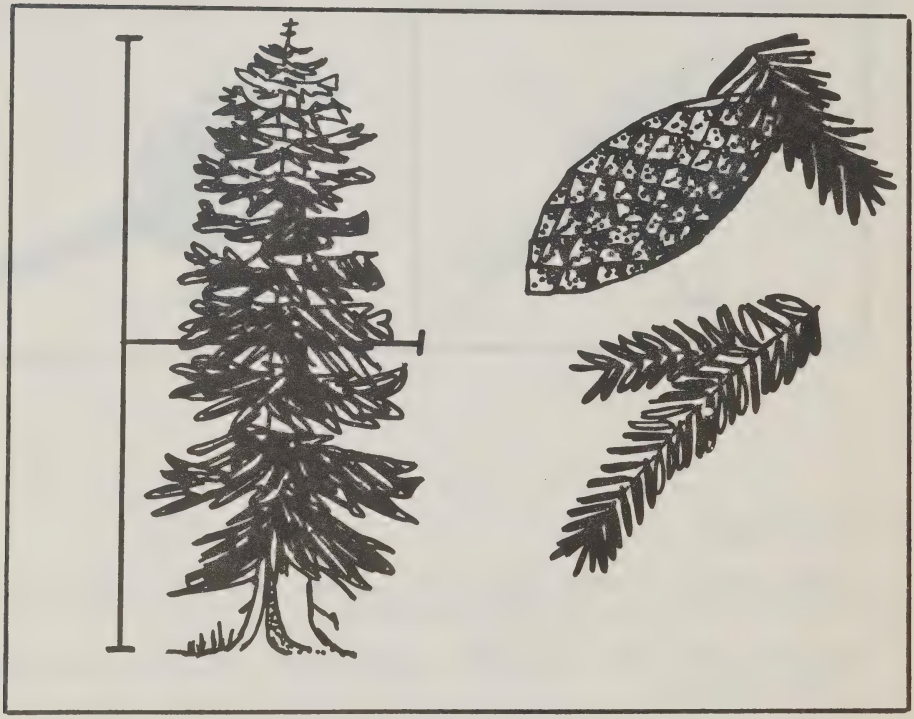
4. Look carefully at the bird and note its special features to complete your drawing.

Drawing a Tree

1. Make sure you put the main branches in the correct position and record the date of your drawing, since the shape of the tree may change during the year.

2. Draw a leaf on the same page either in outline or in detail.

3. Draw a flower if the tree has them, and make sure you note the number of petals and the arrangement of the various flower parts.



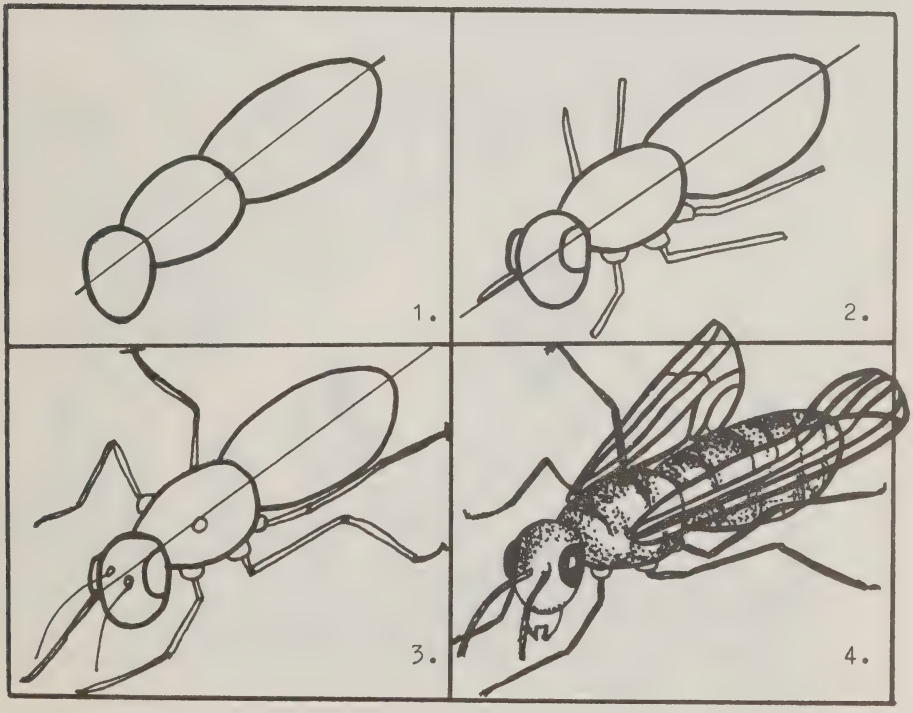
Drawing an Insect

1. Use ovals to represent the head, thorax, and abdomen, lining them up as shown.

2. Add the first parts of the legs, noting where they join the thorax.

3. Complete the legs and add the antennae.

4. Draw in the wings and add modelling to make drawing lifelike.



Sources

BOOK LIST

Unless indicated otherwise, these materials may be obtained from the Nature Canada Bookstore, 75 Albert Street, Ottawa, Canada K1P 6G1. All prices are subject to change.

Identification Guides

The Audubon Society Field Guide to North American Birds
John Bull and John Farrand, Jr.
Albert A. Knopf, New York. $8.95

Natural History Notebook
National Museum of Natural Sciences
Sketches and brief notes on 52 magnificient creatures in our animal kingdom.
National Museums of Canada, Ottawa, Ontario K1A 0M8 $1.00

Peterson Field Guides

The Peterson Field Guides are the most famous and widely-used field guides in North America. Based on the Peterson principle of visual identification, they are invaluable to naturalists and students.

A Field Guide to:

The Birds (Eastern)
Roger Tory Peterson
$11.95; paper $6.75

Western Birds
Roger Tory Peterson
$11.95; paper $7.95

Atlantic Shells
Percy A. Morris
$11.95; paper $9.25

Butterflies (Eastern)
Alexander B. Klots
$14.75; paper $9.25

Mammals
William H. Burt
$13.50; paper $7.95

Pacific Coast Shells
Percy A. Morris
$7.95; paper $5.50

Rocks and Minerals
Federick G. Pough
$14.75; paper $9.25

Animal Tracks
Olaus J. Murie
$9.25; paper $7.95

Ferns
Boughton Cobb
$9.25; paper $6.75

Trees and Shrubs
George Petrides
$9.95; paper $7.95

Eastern Reptiles and Amphibians
Roger Conant
$13.50; paper $9.25

Rocky Mountain Wildflowers
Craighead, Craighead and Davis
$9.25; paper $7.95

Stars and Planets
Donald H. Menzel
$11.95; paper $7.95

Western Reptiles and Amphibians
Robert Stebbins
$13.50; paper $9.25

Wildflowers (Eastern)
Peterson and McKenny
$11.95; paper $7.95

Insects
Borror and White
$11.95; paper $7.95

Mexican Birds
Roger Tory Peterson
$14.75

Birds' Nests
Hal. H. Harrison
$11.95

Pacific States Wildflowers
Theodore F. Niehaus
$15.50

Eastern Edible Wild Plants
Lee Peterson
$11.95

Golden Nature Guides

These 160 page books overflow with accurate full-color illustrations and interesting information which makes learning easy and enjoyable.

Birds	$1.95
Botany	$1.95
Butterflies and Moths	$1.95
Ecology	$1.95
Fishes	$1.95
Flowers	$1.95
Fossils	$1.95
Geology	$1.95
Insects	$1.95
Mammals	$1.95
Non-Flowering Plants	$1.95
Pond Life	$1.95
Reptiles and Amphibians	$1.95
Rocks and Minerals	$1.95
Seashores	$1.95
Spiders	$1.95
Stars	$1.95
Weeds	$1.95
Zoology	$1.95

Books

International Show-And-Do Conservation Project Kit
World Scout Bureau/World Wildlife Fund.
Individual charts on projects involving soil, water, air, wildlife and litter.

Enjoying Nature with your Family
Michael Chinery
Interesting projects and experiments to increase your knowledge of nature using easily available materials. $16.75.

Environmental Studies for Special Education Teachers
Jane Watson, John Zolomij
Collection of environmental activities that have been used in working with handicapped children. Ontario Ministry of the Environment. 1978. $2.00.

Exploring Nature with Your Child
Dorothy Shuttlesworth
Practical field study advice on all types of flora and fauna as well as projects for the family. Numerous color photographs. Harry N. Abrams, Inc., Publishers, New York. $18.50.

Art Lessons that Teach Children About Their Natural Environment
Ruth Peck
More than fifty art lesson plans designed to help make elementary school children more aware of themselves and their relationship to their environment. Parker Publishing Co., West Nyark, New York. $14.95

Canadian Wildflowers (1976)
Mary Ferguson and Richard M. Saunders
A lovely portfolio of native wildflowers. Complete botanical details and a short descriptive text are included. $19.95

Trees of North America
Brockman et al.
A field guide with color illustrations located opposite the text and range maps. $9.95; paper $4.95

Common Marsh, Underwater and Floating-leaved Plants of the U.S. and Canada (1970)
N. Hotchkiss
paper $4.45; $4.95

Common Weeds of Canada/Les mauvaises herbes communes du Canada (1976)
Gerald A. Mulligan
A compendium of Canada's most prevalent weeds, illustrated with color photographs. paper $6.95

The World You Never See: Insect Life (1976)
Theodore Rowland-Entwistle
An excellent introduction to the diversity of insect form and behaviour with full color photographs throughout. $13.50

Constellations: A Concise Guide in Color (1969)
Joseph Klepesta and Antonin Rukl
A color map of each of the 88 constellations plus information on the distance, apparent and absolute magnitudes and type of stars in each constellation. $3.95

Stars and Planets
Ian Ridpath
A beautifully illustrated, up-to-date tour of the solar system. The development of modern viewing techniques and phenomena such as pulsars, quasars and black holes are clearly explained. $7.95

Gardening with Wildlife
National Wildlife Federation
A comprehensive gardening book to show how to raise a garden, and how to create and enjoy an entire natural backyard habitat. Beautifully illustrated. National Wildlife Federation, Washington, D.C. $12.95

Freshwater Ecology
William A. Andrews
An introduction to the basic principles of freshwater ecology and a look at the life which can be found in lakes and ponds. Prentice-Hall of Canada, Ltd. Scarborough, Ontario. 1972

Annotated Checklist of the Birds of Ontario
R.D. James, P.L. McLaren, J.C. Barlow
75% of the birds known to occur in Canada have been recorded in Ontario. This book lists these species with summary information on breeding, frequency, abundance, seasonal distribution, migratory status and the subspecies found in the Province. Paper $2.50

The Audubon Society Book of Wild Birds
Les Line and Franklin Russell
Familiar and exotic birds are captured with a breathtaking fidelity to color and detail by 67 outstanding bird photographers. A richly informative text complements the 203 color photographs. If birds mean anything to you, you will never tire of looking through this glorious book. $45.00

Wildlife's Christmas Treasury
National Wildlife Federation
Includes reflections on winter, wildlife information, instructions on Christmas decorations, songs and stories. National Wildlife Federation, Washington, D.C. $9.95

Great Canadian Animal Stories
edited by Muriel Whitaker
Sixteen stories by Farley Mowat, Grey Owl, Jack London, Ernest Thompson Seton, Charles G.D. Roberts and others are in this collection for animal lovers. $12.95

Wildlife's Holiday Album
National Wildlife Federation
An anthology of nature lore and holiday customs throughout the year. Filled with color photographs. National Wildlife Federation, Washington, D.C. $9.95

Experiences with Plants for Young Children
Frank C. Gale and Clarice W. Gale
Science experiences designed for teachers and parents to use with four-and-five-year-olds. Pacific Books, Publishers, Palo Alto, California.

Nature Activities for Early Childhood
Janet Nickelsburg
Designed to help parents and teachers provide young children with experiences in observing nature so as to stimulate them to adventure into the unknown. Addison-Wesley Publishing Co., Don Mills, Canada. $7.50

Dyes from Lichens and Plants : A Canadian Dyer's Guide
Judy Waldner McGrath
The fundamental principles which underlie the art of natural dyeing are brought together in one book to help us rediscover the subtle beauty of the colors stored in the lichens and plants around us. $14.95

Field Guide to Edible Wild Plants
Bradford Angier
A quick, all-in-color identifier of more than 100 edible wild foods growing free in the U.S. and Canada. Stackpole Books, Harrisburg, P.A. $4.95

Photography for the Joy of It
Freeman Patterson; colour photographs by the author
As a well-known photographer and photography teacher, Freeman Patterson has developed a reputation in this country for his ability to awaken in photographers a new sense of enjoyment and direction in their craft. Now he has written a book to help both novice and experienced photographers to use photos to communicate ideas and emotions. Paper $9.95

Field Photography: Beginning and Advanced Techniques
Alfred A. Blaker
One of the best books on the subject. $23.95

Children's Books

Outdoor Things to Do
William Hillcourt
Year-round nature fun for girls and boys. Western Publishing Co., Inc. Racine, Wisconsin. $8.10

Animals in Your Neighbourhood
Seymour Simon
Exploring the natural world in your own neighbourhood. About pigeons, sparrows, ants, moths, butterflies, spiders, earthworms and squirrels. Ages 7-9. Walker and Company, New York. $5.50

Days In the Woods
A. Harris Stone and Dorian Brooks
An introduction to the plants, animals and sounds one might encounter on a walk through the woods. Prentice-Hall, Englewood Cliffs, N.J.

Holiday in the Woods
Anne Francis
A young boy spends his summer holiday with relatives at their cottage in the Laurentians and discovers many fascinating things about animals, their habits and the sounds they make. One of the best nature adventure stories available. For readers 8-12. Clarke, Irvin & Co. Ltd., Toronto. $6.95

Where Does the Garbage Go?
Paul Showers
A Let's-Read-and-Find-Out- Science Book for young children. Explains what happens to our garbage once it has been dumped--where it goes and how it can be used. Thomas Y. Crowell Co., N.Y. $4.55

Something to Make, Something to Think About
Martha Olson Condit
An unusual project book for youngsters. Instructions are included for such things as magic forests, waterscopes, sun clocks, flower faces and bird spinners. Four Winds Press, New York. $4.95

Fun with Naturecraft
Avery Nagle and Joseph Leeming
Nuts, feathers, pine needles, seeds and many other things easily collected near the home can be turned into beautiful, practical, low-cost gifts, games and toys. J.B. Lippincott Company, N.Y. $6.95

The New Air Book
Melvin Berger
Describes the composition and characteristics of air, its indispensability to plants and animals, and the necessity of keeping air fit to breathe. Thomas Y. Crowell Company, New York. 1974

American Wildflowers Coloring Book
P.E. Kennedy
Paper $1.95

Audubon's Birds of America Coloring Book
P.E. Kennedy
Paper $1.95

Canada's Monsters (10 years and up)
Betty Sanders Garner
A colorfully illustrated account of such strange creatures as the sasquatch and Ogopogo. Paper $4.95

Common Weeds Coloring Book
Stefen Bernath
Paper $1.95

Foxtails, Ferns and Fish Scales: A Handbook of Art and Nature Projects (10 years and up)
Ada Graham
$9.98

Garden Flowers Coloring Book
Stephen Bernath
paper $1.95

Growing a Green Thumb (8 years and up)
Loraine Surcouf
An excellent Canadian book on starting a garden -- digging, planting, watering, insect enemies, birds, toads and all the other activities that children do in and with a garden.
Paper $3.95

Herbs Coloring Book
Stephen Bernath
Paper $1.95

The Long Ago Lake: A Child's Book of Nature Lore and Crafts (10 years and up)
Maine Wilkins
Making things from the offerings of woods and fields with the emphasis on how to be outdoors responsible. $11.50; paper $6.95

Look, Mom, It's Growing (5-12 years)
Ed Fink
Easy projects to delight and instruct children in the basics of gardening. Paper $3.95

Lost in the Barrens (8-12 years)
Farley Mowat
paper $2.95

Owls in the Family (8-12 years)
Farley Mowat
The humourous tale of two owls who turned an entire household upside down. $7.50; paper $1.95

Life and Death in Nature
Seymour Simon
Examines the functional purpose of death in the plant and animal world and shows how plants and animals serve as food for other animals and how plants absorb decayed matter. McGraw-Hill Book Company, 1976.

It's About Birds
May Garelick
Describes the characteristics and habits of birds found in the city, country, zoo and at the beach. Holt, Rinehart and Winston, New York. 1978 $9.05

A Spider Might (8 years and up)
Tom Walther
A book about the amazing things a spider might do. For anyone who only thinks of spiders as creepy or scary, here is a whole new way to look at them. $9.95; paper $5.95

The View from the Oak: The Private Worlds of Other Creatures (10 years and up)
Judith and Herbert Kohl
This book explores the ways in which living creatures experience space, sense time and communicate with others of their kind. Paper $5.95

The Wind in the Willows (5 years and up)
Kenneth Grahame, illustrated by Ernest H. Shepard
The classic tale of Mole who walks away from his spring-cleaning into great adventures with Rat, Toad and Badger.
Paper $4.95

NATURE RECORDINGS*

Cries of the Wild (Stereo)
Wilderness sounds from four continents.
$6.30 $7.00

Land of the Loon
Loons, wolves and songbirds, as featured in Dan Gibson's award-winning films.
$6.30 $7.00

Voices of the North Woods
45 RPM - various loon calls, birds, frogs and wolves.
$1.40

Recordings to Accompany Peterson Bird Guides
Available in cassette or record form. Each set is accompanied by a compact booklet listing very song, call and place of recording.

Field Guide to Bird Songs (Eastern)		
Two cassettes	$26.75	$29.75
Two records	$23.85	$26.50
Field Guide to Western Bird Songs		
Three cassettes	$32.20	$35.75
Three records	$26.55	$29.50

Sounds of Nature Series
An excellent series of recordings by Dr. W.W.H. Gunn

Songs of Spring
25 of the most common songbirds of Southern Ontario
$6.25 $6.95

A Day in Algonquin Park
Voices of the forest, marsh and lake. A summer's day from dawn to dusk. No narration.
$6.25 $6.95

Warblers
400 songs from 38 species of warbler.
$6.25 $6.95

Finches
400 songs from 43 species of Fringillids
$6.25 $6.95

Prairie Spring
64 bird species as well as coyotes, ground squirrels and prairie dogs.
$6.25 $6.95

Thrushes, Wrens and Mockingbirds
Songs and calls of more than 100 birds of 17 species.
$6.25 $6.95

Birds of the African Rain Forests
92 species of birds recorded in the rain forests of East-Central Africa. 2 LP records.
$11.65 $12.95

Sounds of Algonquin
Produced by Dan Gibson
A 15 minute 33 1/3 rpm record.
Side a: Loons and Wolves
Side b: Evening Paddle
$1.95

NATURE SOUNDS OF NORTH AMERICA
Cassettes recorded by Dan Gibson, 30 minutes per volume, minimum of one minute recording time per species.

C.1: Brown thrasher, song sparrow, red-winged blackbird, warbling vireo, bobolink, Baltimore oriole, eastern phoebe, and nine more.
$6.25 $6.95

C.2: Northern waterthrush, whip-poor-will, house wren, myrtle warbler, scarlet tanager, catbird, red-eyed vireo, and nine more.
$6.25 $6.95

C.3: Bewick's wren, orange-crowned warbler, purple finch, MacGillivray's warbler, rufous-sided towhee, Audubon's warbler, and nine more.
$6.25 $6.95

C.4: Common loon, ring-billed gull, great blue heron and fourteen more including squirrels, timber wolves and five species of frogs. $6.25 $6.95

SAVE: Buy all four of the above cassettes (regular retail price $27.80) for only $23.00

* Available from Nature Canada Bookshop, 75 Albert Street, Ottawa K1P 6G1